The ICU discharge process

Making the connection between ICU and ward

Nelleke van Sluisveld

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The studies presented in this thesis have been performed at the Department of Intensive Care Medicine and the Scientific Institute for Quality and Safety of Healthcare (IQ healthcare). IQ healthcare is part of the Radboud Institute for Health Sciences (RIHS), one of the approved research institutes of the Radboud University Nijmegen Medical Centre.

The studies described in this thesis were funded by ZonMw, the Netherlands Organisation for Health Research and Development (dossier number: 171203006).

Financial support by the Department of Intensive Care Medicine for the publication of this thesis is gratefully acknowledged.

ISBN: 978-94-92380-36-4

Nijmegen, 2017

Cover Design: Tinykiwi Prints
Lay-out: Nelleke van Sluisveld
Print: GVO drukkers en vormgevers B.V. | Ponsen & Looijen, Ede

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Proefschrift

Ter verkrijging van de graad van doctor
aan de Radboud Universiteit Nijmegen
op gezag van de rector magnificus prof. dr. J.H.J.M. van Krieken,
volgens besluit van het college van decanen
in het openbaar te verdedigen op woensdag 10 mei 2017
om 10.30 uur precies

door
Petronella Helena Johanna van Sluisveld

geboren op 18 november 1986
te ’s-Hertogenbosch

Promotoren:	Prof. dr. J.G. van der Hoeven Prof. dr. G. Westert
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Manuscriptcommissie:	Prof. dr. C.J.H.M. van Laarhoven Prof. dr. P.H.J. van der Voort (Tilburg University) Prof. dr. H. Vermeulen

Contents

Chapter	Title	Page
Chapter 1	General introduction	7
Chapter 2	A strategy to enhance the safety and efficiency of handovers of ICU patients: study protocol of the pICUp study *Implementation Science 2013;8:67.*	15
Chapter 3	Improving clinical handover between intensive care unit and general ward professionals at intensive care unit discharge: a systematic review *Intensive Care Medicine 2015;41:589.*	31
Chapter 4	Variation in ICU readmissions and post-ICU mortality related to ICU discharge practices *Submitted.*	57
Chapter 5	Ethical problems in intensive care unit admissions and discharge decisions: a qualitative study among physicians and nurses *BMC Medical Ethics 2015;16:9.*	81
Chapter 6	Barriers and facilitators to improve safety and efficiency of the ICU discharge process: a mixed methods study *BMC Health Services Research: accepted for publication.*	103
Chapter 7	General Discussion	133
	Summary	143
	Samenvatting	147
	Dankwoord	151
	Curriculum Vitae	155
	Bibliography	159

Chapter 1

General introduction

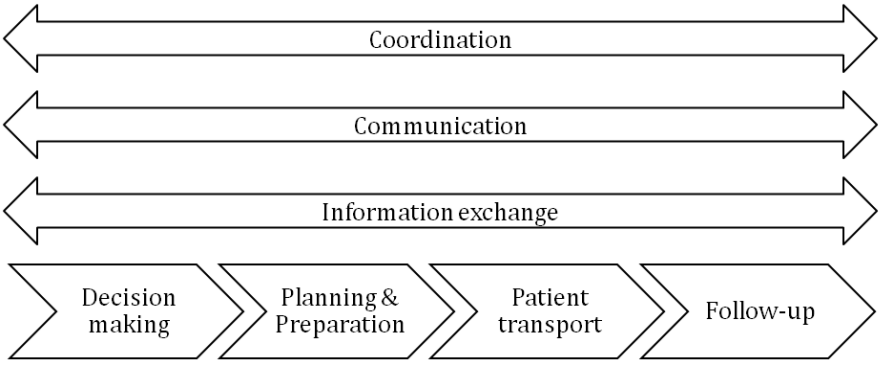
CLINICAL HANDOVER IN GENERAL

Clinical handover is defined by the Australian Medical Association as 'the transfer of professional responsibility and accountability for some or all aspects of care for a patient, or group of patients, to another person or professional group on a temporary or permanent basis'[1]. The purpose of clinical handover is to provide accurate information about a patient's care and treatment, patients preferences, current condition and any recent or anticipated changes[1]. Effective handover should facilitate continuity of care across care settings, promote coordination of care amongst healthcare professionals and maintain high quality and safe patient care[2].

Handover occurs in a variety of settings and between several types of healthcare providers. Trans-mural handover, handover between institutions, occurs between a hospital and a nursing home and between community services and institutions, for example between a primary care physician and a surgeon. In-hospital handovers take place between shifts or between departments, for example from the emergence department to an operating theatre. Clinical handover is an everyday practice for healthcare professionals; shift handovers take place two or more times daily, seven days a week[3]. Healthcare professionals, however, receive little formal training in this critical responsibility[3]. The number of handovers is increasing as a result of duty hours restrictions and part time working professionals, resulting in increased opportunities for discontinuity of care.

Although handover processes vary considerably between settings, there are commonalities in structure and purpose[4]. Essential components of the handover process are 1) information exchange, i.e., the quality of information that is exchanged between healthcare professionals, 2) coordination of care, i.e., the quality of assessment, planning and organisation of diagnostics, treatments and medication prescribed and provided by different healthcare professionals, and 3) communication, i.e., the quality of exchanging information in terms of personal and direct contact, accessibility and timeliness[5] (see Figure 1.1).

Figure 1.1. Model of handover components or phases



Clinical handover is internationally acknowledged as an essential component of quality of care and as a high-risk episode in the care process of many patients[6]. Incomplete or incorrect information transfer and communication errors between healthcare professionals lead to information breakdowns and misunderstandings. They may result in poor continuity of care and subsequently, in adverse outcomes for patients.

CLINICAL HANDVER ON THE ICU

Patients treated in a intensive care unit (ICU) may be particularly vulnerable to poor clinical handover, given the number, complexity and acuity of the medical conditions that characterize this patient group[7]. Especially vulnerable are patients who are discharged from an ICU to a general ward. They undergo a significant transition in care leaving the ICU, where medical care is intensive and resources are rich, going to a general ward where patients receive much less intensive monitoring and patient care[8,9].

Clinical handover between ICU and general ward is a complex process, and four chronological phases can be distinguished (see Figure 1). In the first phase, the decision to discharge a patient from the ICU is made. Discharge criteria can be used to determine if the patient is ready to be discharged from the ICU. The second stage involves planning and preparation to discharge the patient, such as liaison with the receiving ward, reduce medical technology[10], preparing discharge forms, and organising follow-up services. Third is the transport of the patient from the ICU to the general ward and the transfer of the responsibility and accountability to the general ward. The fourth stage is the post-ICU period, in which a follow-up of the patient by ICU professionals on the general ward may take place. Examples of follow-up care are that ICU professionals are available for answering questions of general ward professionals, for providing assistance with complicated nursing care, and for checking up on the patient.

Methods for the exchange of information or information handover are verbal, i.e., face-to-face or via telephone, and written, i.e., on paper or electronic. There have been many studies that showed the inadequacies of information transfer using different handover methods. Greenberg and colleagues[11], for example, showed that 92% of the identified information breakdowns in surgical malpractice claims were verbal.

The ICU discharge process is a multidisciplinary process, involving collaboration amongst physician, nurses, physical therapist, pharmacists, ward clerks and support systems, both in the ICU and general ward[12]. Multidisciplinary clinical handover is likely to face relatively greater communication barriers as a result of cultural differences, work load challenges and differences in clinical focus between specialties and disciplines, and may lead to greater potential for patient safety breaches[13,14].

SUBOPTIMAL CLINICAL HANDOVER

Mrs. Smith is 75 years old and admitted 13 days ago to the ICU with a septic shock. Since two days Mrs. Smith is extubated, stable and she does not need intensive monitoring or ICU treatments anymore. Because there is no bed pressure and Mrs. Smith still needs a lot of nursing care, it is decided to let her stay in the ICU for another day. That night, three patients are acutely admitted and to free up a bed, Mrs. Smith is transferred to a general ward that night. Two days later Mrs. Smiths is readmitted to the ICU with respiratory failure.

Clinical handover, especially handover from ICU to ward, is a high-risk episode in patient care. Suboptimal handover may result in poor continuity of care and in adverse patient outcomes. Examples of suboptimal handover from ICU to general ward are premature discharge, incomplete or incorrect information transfer, and communication errors. Williams and colleagues found that communication errors are involved in one-third of major cardio-respiratory events in the ICU, occurring more frequently during the late shift[15]. In literature, night-time ICU discharges are considered premature and, hence, an indicator for suboptimal quality of care[16]. They are nearly always caused by triage in an acute situation in case of limited ICU bed capacity[17]. Patient discharged from the ICU at night-time were readmitted or died in hospital significantly more often than patients discharged during the day[18,19].

Clinical handover from ICU to general ward is complicated by several factors, such as patient factors, healthcare professional factors, interpersonal factors, organisational factors and environmental factors[3,4,20]. Patients treated in the ICU have more, more complex and more acute medical conditions than any other patient group in a hospital. More, more complex and more acute medical information needs to be exchanged, and errors are likely to have a larger impact on these vulnerable patients. Healthcare professionals may influence the quality of clinical handover by a lack of knowledge about a good clinical handover, and lack of experience or skills. But also a lack of concentration or fatigue while exchanging information will influence the quality of information sent or received. Examples of inter-personal, team or cultural factors that may negatively influence handover are a lack of collaborative attitude, lack of shared communication, such as different abbreviations or jargon, lack of leadership, and no culture of feedback. Organisational factors include a lack of standardisation, protocols, policies and tools, high workload, lack of skilled staff, high ICU bed occupancy, no shared information systems, and lack of financial resources.

Suboptimal and premature handover may result in adverse patient outcomes, which can be both physical complications, such as adverse drug events, morbidity or mortality, and psychological complications, such as feelings of fear, anxiety or depression[21]. It may also result in inefficiencies, such as avoidable ICU readmissions and re-hospitalisations, increased length of ICU or hospital stay, delays in medical diagnoses and treatments, and

over- and underuse of diagnostics, treatments and medication. Intensive care is the most expensive service provided by hospitals, with costs per bed three to six times higher than the costs of a bed on a general ward[22,23]. In the United States of America, ICU beds comprise less than 10% of hospital beds, but ICU departments consume up to 22% of the total hospital budget[22,24]. Also, the costs of ICU departments in the Netherlands have been estimated to represent approximately 20% of the total hospital budget[25]. As a result, ICU facilities are a scarce commodity and efficient use is indispensable. Increased pressure on ICU beds, however, may result in premature or suboptimal discharge[12].

ICU READMISSIONS

The prevention of ICU readmission by improving the ICU discharge process, is of clinical as well as of economical importance. Patients readmitted to the ICU have a higher risk on adverse events than non-readmitted patients; in-hospital mortality rates are up to five times higher[26]. Furthermore, less ICU readmission results in a more efficient use of ICU beds, because readmitted patients occupy ICU beds which otherwise could be used for new ICU patients. Furthermore, Nishi and colleagues showed that approximately 37% of readmissions within 48 hours are potentially preventable[27], which may indicate the possibility to decrease healthcare costs by preventing ICU readmissions.

RESEARCH QUESTIONS AND OUTLINE OF THESIS

The aim of this thesis is to assess the practice and outcome variation in ICU discharge processes in the Dutch ICU, to indicate effective interventions aiming to improve the ICU discharge process and to prevent ICU readmissions and post-ICU mortality, and to get insight into factors influencing the implementation of these interventions. The design and methods of the pICUp study are described in Chapter 2.

The following research questions are addressed:
How to analyse problems regarding the implementation of ICU guidelines and interventions? In Chapter 2 we describe a framework that provides insight into the process of the implementation of scientific evidence, and factors influencing this process.

What are effective ICU discharge interventions to prevent ICU readmissions and hospital mortality after ICU discharge? In Chapter 3 we described a systematic review of literature of interventions aiming to improve the ICU discharge process.

What is the variation in ICU readmissions and hospital mortality after ICU discharge between ICUs? In Chapter 4 we described the extent of the variation in ICU readmissions and post-ICU in-hospital mortality between the Dutch ICUs.

What is the variation in ICU readmissions and post-ICU mortality between Dutch hospitals, and what is the association between ICU readmissions and post-ICU mortality and ICU discharge practices? In Chapter 4 we described the variation in rates of ICU readmissions within 48 hours and post-ICU in-hospital mortality in individual hospitals. Furthermore, we described the assessment of practice variation between Dutch ICUs in ICU discharge practices, and whether or not this variation is associated with the variation in ICU readmissions and post-ICU mortality.

With which ethical dilemmas are healthcare professionals faced with during the ICU admissions and ICU discharge process? In Chapter 5 we identified and explored ethical dilemmas in the ICU admission process, during the ICU stay and in the ICU discharge process.

What are the barriers and facilitators to the implementation of these ICU discharge interventions? In Chapter 6 we described factors which negatively or positively influence the implementation of interventions aiming to improve the ICU discharge process.

Finally in Chapter 7, the general discussion, presents and discusses the main findings in their broader theoretical and practical context. We also discuss methodological considerations of the designs used in this study and we reflect on implications of our findings for practice and future research.

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Chapter 2

A strategy to enhance the safety and efficiency of handovers of ICU patients: study protocol of the pICUp study

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Marieke Zegers
Gert Westert
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Hub Wollersheim

Implementation Science 2013;8:67.

ABSTRACT

Background: To use intensive care unit (ICU) facilities efficiently and ensure high quality of care, an optimal patient flow is necessary. Discharging patients relieves the pressure on ICU beds but the risk of premature discharge must be managed carefully. Suboptimal patient discharge may result in ICU readmissions and in patients' death. The aim of this study is to obtain insight into the safety and efficiency of current ICU discharge practices and into barriers and facilitators to the implementation of effective ICU discharge interventions, and to develop an implementation strategy tailored to the barriers and facilitators identified.

Methods/design: This study exists of five phases. Phase A: analysis of routinely registered data on variation in ICU readmissions and hospital mortality after ICU discharge of all ICUs participating in the Dutch National Intensive Care Evaluation registry (n = 83). Phase B: systematic review of effective interventions aiming to improve the efficiency and safety of the ICU discharge process. Phase C: assessing the intervention adherence with a questionnaire survey among all Dutch ICUs (n = 90). Phase D: assessing barriers and facilitators to the implementation of effective ICU discharge interventions with a questionnaire survey among all Dutch intensivists (n = 700). The questionnaire will be based on barriers and facilitators identified by focus groups (n = 4) and individual interviews with professionals of ICUs and general wards, and adult discharged ICU patients (n = 25 to 30). Phase E: systematic development of an implementation strategy based on the sampled data in phase A to D, and effective implementation strategies from the literature using the Intervention Mapping method.

Discussion: Using theory and empirical data, an implementation strategy will be developed to improve the safety and efficiency of the ICU discharge process. The developed strategy will be evaluated in a subsequent study. The knowledge obtained in this study should be used for further implementation of ICU discharge interventions, and can be used for implementation of handover interventions in other healthcare settings.

BACKGROUND

The intensive care unit (ICU) is an essential component of most large hospitals, providing critically ill patients with high quality care. In addition, patients undergoing major surgery often require ICU admission postoperatively[1]. Therefore, ICUs are often under forward pressure from operating theatres and the emergency room for beds[2]. At the moment, ICU facilities are scarce, and the need for ICU beds will increase in the future as the population ages. Although ICU beds comprise less than 10% of hospital beds, ICU departments consume up to 22% of total hospital costs in the United States[3,4]. As a consequence, efficient use of ICU facilities has become a priority.

An optimal patient flow is critical to use ICU facilities efficiently and to ensure high quality of care. Discharging patients is one way of relieving the pressure on ICU beds but clearly, the risk of premature discharge must be managed carefully[1]. The increased pressure on ICU beds may result in premature and suboptimal discharge leading to ICU readmissions and even in patients' death[5-7]. ICU readmission rates and hospital mortality after ICU discharge vary. Hospital mortality after ICU discharge is 12.4% in the United Kingdom, of which 39% is related to premature ICU discharge[8]. Other studies show a variation in hospital mortality rates after ICU discharge between 4.5% and 12.4%[8-13]. ICU readmission rates vary between 0.89% and 19%[12,14-16].
ICU readmissions are an important cost driver. The mean unit price of an ICU day in the Netherlands is €2,183[17]. According to the Dutch National Intensive Care Evaluation (NICE) registry in 2011, approximately 75,000 patients were admitted to the ICU. A reduction of the readmissions rate with 1% (from 6.8% to 5.8%), assuming a median ICU stay of one day, could save 1.6 million euro per year.
The question is: How to prevent ICU readmissions and mortality after an ICU stay? What are available effective improvement interventions and are they used in daily practice? In addition to existing guidelines[18-21], literature describes several evidence-based interventions that focus on organizational changes to improve the safety and efficiency of the ICU discharge process, such as discharge planning[22], monitoring of post-ICU patients[23], medication reconciliation[24], and ICU liaison nurses[25,26]. Adoption of guidelines and improvement interventions in clinical practice has proven to be difficult. Adherence to guidelines and interventions may be hindered by a variety of barriers[27,28]. Better implementation of existing guidelines and interventions aimed at improving the handover of patients from the ICU to general wards may reduce ICU readmissions and hospital mortality. As a positive side effect, avoiding ICU readmissions will reduce hospital costs substantially.

Objective

The aim of the pICUp (Patient Handover Intensive Care Unit Improvement) study is to obtain insight into current ICU discharge practice, an overview of effective ICU discharge interventions and into the factors that hinder and facilitate the implementation of these interventions (barriers and facilitators), with the final aim to develop a tailored implementation strategy. A better understanding of the barriers and facilitators and a tailored strategy will enhance the implementation of interventions in daily practice and will improve the quality of the ICU discharge process, leading to fewer adverse patient outcomes, such as fewer ICU readmissions and reduced hospital mortality after ICU discharge.
The following research questions are formulated to address this aim:

- What is the variation in ICU readmissions and hospital mortality after ICU discharge between ICUs?
- What are effective ICU discharge interventions to prevent ICU readmissions and hospital mortality after ICU discharge?
- What is the adherence to these interventions?

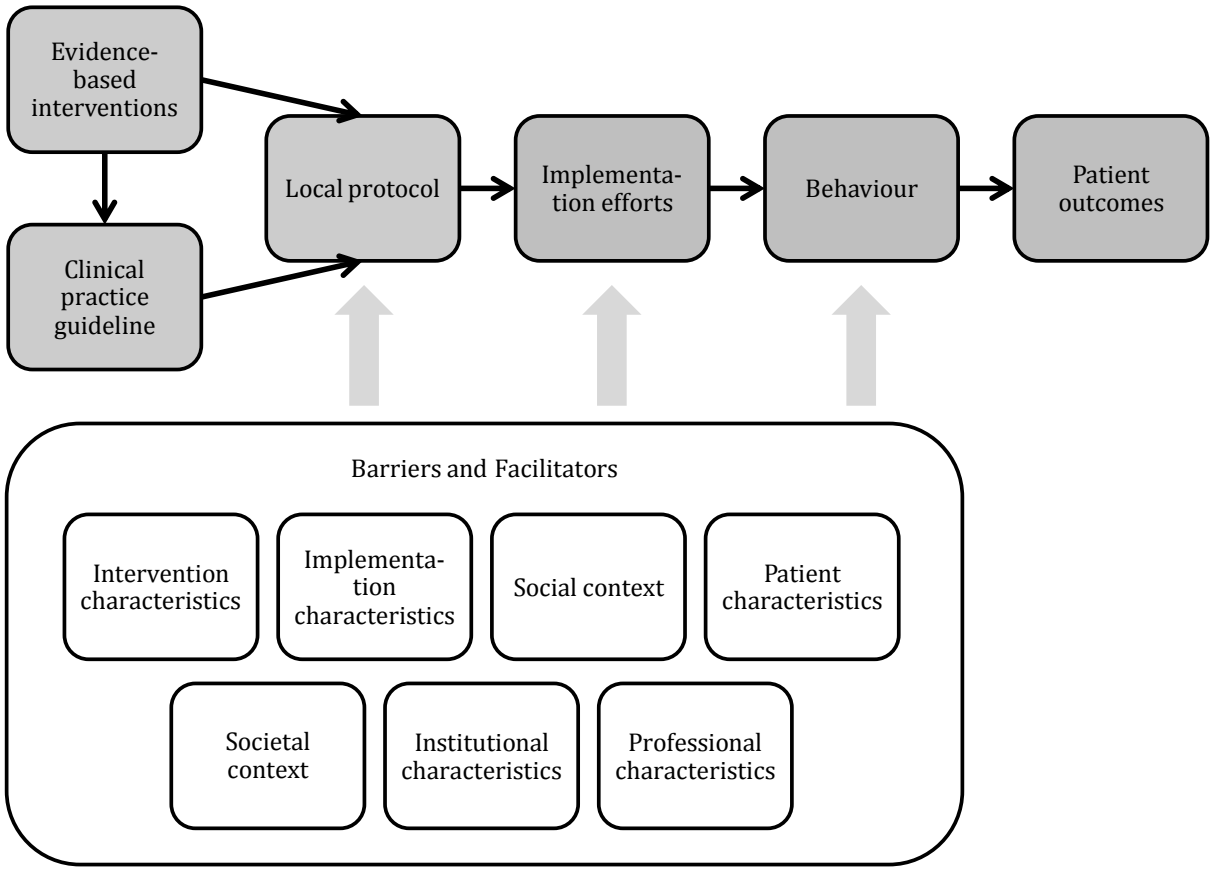
- What are the barriers and facilitators to the implementation of these ICU discharge interventions?
- What is an appropriate strategy to improve the implementation of these ICU discharge interventions?

Theoretical framework

To answer the research questions and structure the analysis, we developed a framework that provides insight into the process of the implementation of scientific evidence, and factors influencing this process (Figure 2.1). This framework is based on three models related to implementing change: the implementation of change model of Grol and Wensing[27,29]; the framework of knowledge-attitude-behaviour related barriers for guideline adherence of Cabana *et al.*[28]; and the framework for adherence to clinical practice guidelines in the ICU of Cahill *et al.*[30].

The blue boxes reflect the temporal sequence of the implementation process from scientific evidence to improved patient outcomes: I) scientific research results in evidence about effective interventions that are recommended in clinical practice guidelines, II) the evidence should be tailored to local circumstances in local protocols, III) implementation efforts, such as a detailed and feasible implementation plan, and engaging stakeholders in an early stage, will improve the implementation process, leading to IV) improved behaviour and adherence to the intervention of stakeholders, and ultimately resulting in V) improved patient outcomes.

Figure 2.1. Framework for the implementation of guidelines and interventions



Several factors influence the implementation process and could explain why effective and evidence-based interventions are not (fully) implemented. Based on literature, barriers and facilitators to implementation can be categorized in seven main domains[27-29,31], represented by the white boxes in Figure 1. The domains are related to the: 1) characteristics of the intervention; 2) societal context; 3) characteristics of the implementation efforts; 4) characteristics of the healthcare facility; 5) social context (*e.g.*, interpersonal, interdepartmental and inter-institutional relationships); 6) professional characteristics; and 7) patient characteristics. Subcategories of these main domains are presented in Table 2.1.

Table 2.1. Theoretical framework for classifying barriers and facilitators, based on Grol and Wensing, Cabana et al. and van Sluisveld et al.[27-29,31]

Intervention characteristics	Advantages in practice; feasibility; credibility; accessibility; attractiveness; usefulness; presence of contradictory guidelines
Societal context	Social developments; political developments and policies; legal obligations and regulations; financial arrangements; moral objections
Implementation characteristics	Protocol; implementation strategy; exposure to implementation efforts
Institutional characteristics	Organisation of care processes; organisational structure; time; staff; capacities; resources; structures; technical support
Social context	Culture or social network; opinion of colleagues; leadership; collaboration
Professional characteristics	Cognition; awareness; attitude; motivation; knowledge; skills; behavioural routines
Patient characteristics	Compliance; knowledge; skills; attitude; preferences

Examples of influencing factors related to the intervention are the feasibility to actually incorporate the intervention in daily practice, the credibility of evidence behind the intervention, and the advantages for the healthcare workers or the patients. Societal factors are whether an intervention is reimbursed by healthcare insurers, political climate, policies, and regulations. Factors related to the implementation characteristics are, for example, the availability of an implementation plan, adequate education of professionals, and the degree of exposure of the professionals to the implementation efforts. Influencing institutional factors are for example organizational structure and resource availability. Social interactions within a team or within the network of a healthcare provider may also be of influence; collaboration between care providers or between wards, leadership, and (safety) culture are important factors. Main professional factors are knowledge (such as familiarity with guideline) and attitude (agreement,

outcome expectancy, perceived behavioural control)[28]. Patient characteristics, such as compliance, knowledge, and attitude (such as self-efficacy, subjective norms, degree of confidence) may influence the adherence of the healthcare providers to the intervention. Currently, 30% to 40% of all patients do not receive care according to actual scientific knowledge[32]. We have a limited understanding of the specific factors that determine the success or failure of the implementation of ICU discharge interventions. Identifying these factors may assist in designing tailored and thus more effective implementation strategies[30].

STUDY DESIGN AND METHODS

Study design

The pICUp study is a descriptive, explorative study using a mixed method design. Quantitative methods are analysis of registered clinical data and questionnaire surveys, while qualitative methods (individual interviews and focus group interviews) study variation in patient outcomes, current ICU discharge practice, guideline and intervention adherence, and the barriers and facilitators to implementation. Based on these findings a tailor-made implementation strategy will be developed. According to the research questions, the study is divided into five phases (Figure 2.2):

Analysis of the variation in ICU readmissions and hospital mortality after ICU discharge between ICUs,
Systematic review of evidence-based interventions for improving handover of patients from the ICU to general wards,
Analysis of guideline and intervention adherence and the association between adherence and patient outcomes,
Analysis of barriers and facilitators to the implementation of ICU discharge guidelines and interventions and the relevance of these factors to professionals,
Development of an implementation strategy tailored to the barriers and facilitators found.

Below, we describe the study methods, population, analysis, and outcome measures per study phase. An overview of the research questions, methods and outcomes is given in Table 2.2.

Phase A: analysis of the variation in ICU readmission and hospital mortality after ICU discharge between ICUs
The aim of this phase is to analyze the variation in ICU readmissions and hospital mortality after ICU discharge between ICUs, and the degree of variation not explained by patient mix.

Study design and population

Data about the quality indicators related to suboptimal ICU discharge are derived from the Dutch NICE registry. Since 1996, demographic, physiological, and clinical data of patients admitted to Dutch ICUs are collected. All participating ICUs are obliged to attend training in accurate collection of data to ensure the quality of the registry. At each individual ICU and centrally, data are automatically checked for range and consistency. In addition, quality audits are carried out to ensure the validity of the registration[33,34]. Data of 2011 will be used in this study, in which 83 of the in total 90 Dutch ICUs (92%) participated. In that year, the data of over 74,000 patients of 18 years and older have been collected.

Outcome measures

The variation in patient outcomes will be analyzed using ICU quality indicators related to suboptimal ICU discharge[35,36]. The primary outcome measure is the ICU readmission rate. It is generally assumed that the shorter the time between discharge and readmission, the more likely the ICU discharge was premature. Therefore, readmissions within 48 hours are considered to be related to the quality of the discharge process[15,37,38].

The secondary patient outcome measure is hospital mortality after ICU discharge, which is defined as the percentage of ICU patients discharged alive from the ICU who died on a general ward. In addition, the association between patient's outcomes and discharge time will be analyzed, because we know from previous studies that patients discharged at night experience a greater risk of mortality than patients discharged during the day[1,6,39].

Figure 2.2. Framework for the implementation of guidelines and interventions including phases of the study.

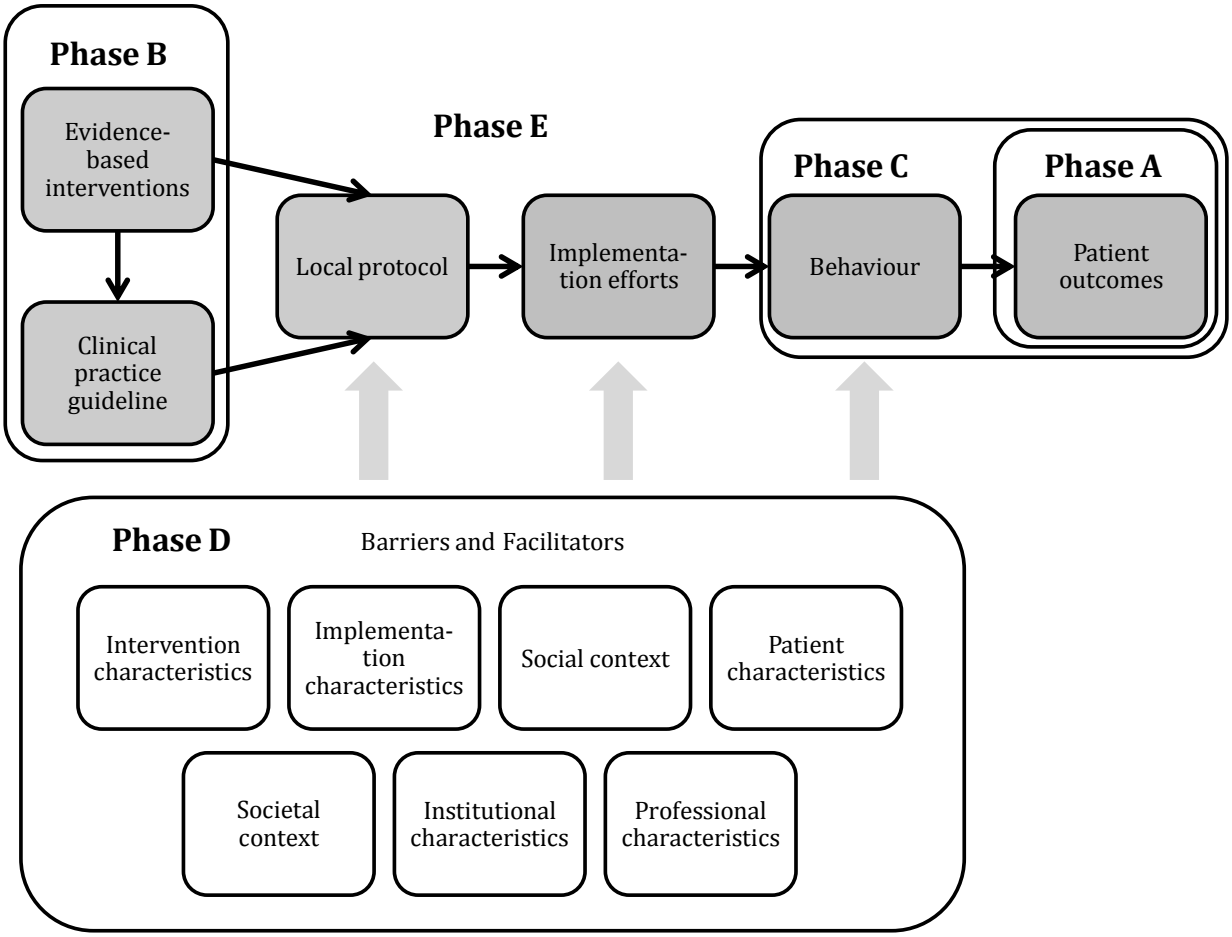


Table 2.2. Research questions, methods, study populations and outcome measures.

Stage	Research questions	Methods	Target group/data sources	Outcome measures
A	What is the variation in patient outcomes regarding ICU discharges?	Analysing variation in quality of care	2011 data from adult patients of all Dutch ICUs participating in the NICE registry (n = 84)	ICU readmissions, ICU mortality, hospital mortality
B	What are effective interventions to improve the safety of the ICU discharge process?	Systematic review	PubMed (including Medline), Cinahl, PsychInfo, Cochrane Database, EMBASE	Overview of effective interventions and effect sizes
C	What is the adherence to guidelines and effective ICU discharge interventions?	Questionnaire to explore adherence	All Dutch ICUs (n = 94)	Adherence to guidelines and use of effective interventions; association between ICU readmissions and mortality (phase A) and adherence (phase B)

D	What are barriers and facilitators to the implementation of guidelines and effective ICU discharge interventions?	Semi-structured individual (n = 25 to 30) and focus group interviews (n = 4)	Intensivists, physicians, nurses and managers of ICUs and general wards, and patients and their relatives	Barriers and facilitators classified according to: 1) intervention characteristics, 2) societal context, 3) implementation characteristics, 4) institutional characteristics, 5) social context, 6) professional characteristics, and 7) patient characteristics
		Questionnaire to quantify findings of the interviews	All Dutch intensivists (n = 700)	
E	What is an appropriate strategy to implement effective interventions to improve the safety and efficiency of the ICU discharge process?	Intervention Mapping method by Bartholomew and Kok[43]	Matching data from previous stages to effective implementation strategies from literature	Implementation strategy tailored to the found barriers and facilitators (phase D)

Analysis

Descriptive statistics will be used to characterize the study sample and to report the variation in hospital mortality rates after ICU discharge and ICU readmission rates. To attribute variation to suboptimal care, the rates will be corrected for patient mix (*e.g.*, age, APACHE IV score, co-morbidity at admission, diagnosis at admission, reason for discharge) and organizational factors (*e.g.*, hospital type and ICU level) using multi level analysis. The remaining variance indicates room for improvement[40].

Phase B: systematic review of evidence-based interventions for improving handover of patients from the ICU to general wards

The aim of this phase is to systematically review literature on effective interventions that aim to improve patient handovers between ICUs and general hospital wards and to evaluate their overall effects.

Methods

We will search for studies using PubMed (including Medline), Cinahl, PsychInfo, the Cochrane Library, and EMBASE. The inclusion criteria will be: studies with experimental study designs; that include patients undergoing and/or healthcare providers involved in the transition from ICU to ward; that have an intervention explicitly describing one or more components aiming to improve the handover from ICU to ward; and that have ICU readmission rate or hospital mortality rate after ICU admission as an outcome measure.

First, studies that do not meet the inclusion criteria will be eliminated based on their title and/or abstract. Full-text copies of studies identified as potentially relevant will be retrieved and reviewed for the final inclusion. The methodological quality of the included studies will be assessed and data such as a description of objectives, design, participants, intervention, and effect measures will be extracted.

Analysis

The study outcomes will be presented in tabular form, and a qualitative assessment will be made based on the methodological quality, sample size, intervention characteristics, outcome, statistical significance, and effect size.

Phase C: analysis of guideline and intervention adherence and the association between adherence and patient outcomes

The aim of this phase is to assess the adherence to the Dutch national guideline[18] and interventions aimed at improving the handover process (such as discharge planning[22], medication reconciliation[24], step down beds[41], monitoring of post-ICU patients[23], and ICU liaison nurses[25,26]), and to analyze the relation between adherence and patient outcomes.

Study design and population

The intervention adherence will be studied using a questionnaire survey, which includes questions about local policies, organization, and procedures regarding the ICU discharge process and the application of ICU discharge interventions. Questions from the questionnaire of the Dutch Healthcare Inspectorate (IGZ) and the visitation questionnaire of the Dutch Society of Intensive Care (NVIC) will be used[35,36]. Moreover, questions will be formulated about interventions derived from the literature review. The questionnaire will be sent to all ICUs in the Netherlands (n = 90).

The association between intervention adherence (questionnaire) and patient outcomes (Phase B) will be analyzed to determine whether adherence leads to better patient outcomes.

Analysis

Descriptive statistics will be used to characterize the study sample and to report the adherence to the guideline and interventions. Regression analysis will be performed to analyze the association between adherence and patient outcomes. Adherence to each discharge intervention will be dichotomised, resulting in one adherence score.

Phase D: analysis of barriers and facilitators to the implementation of ICU discharge guidelines and interventions and the relevance of these factors to professionals

The aim of this phase is to explore the factors influencing the implementation of the ICU discharge guideline[18] and interventions aimed at improving the ICU discharge process[22-26,41].

Study design

A combination of qualitative and quantitative methods will be used to identify and quantify barriers and facilitators to ICU discharge guideline and intervention adherence. First, semi-structured interviews will be conducted to explore all relevant barriers and facilitators to guideline and intervention adherence and opportunities for improvement. The interview questions will be based on a loose structure consisting of open-ended questions that define the area to be explored.

Second, focus group interviews will be conducted to gain broader insight into the barriers and facilitators. For both the individual interviews and the focus groups, an interview guideline will be formulated with a series of open-ended questions to explore barriers and facilitators to inappropriate ICU discharge processes and regarding the implementation of the ICU discharge interventions.

Third, a questionnaire will be developed to quantify the barriers and facilitators identified in the individual and focus group interviews. The questionnaire will contain questions about demographic characteristics, and statements concerning barriers and facilitators regarding the implementation of ICU discharge guideline and interventions identified.

Study population

Approximately 25 to 30 individual interviews will be carried out with managers and healthcare professionals from ICUs and receiving general wards, including intensivists, ICU nurses, and physicians and nurses of general wards. They will be recruited from six hospitals: two general, two teaching, and two academic hospitals.

Furthermore, patients will be interviewed together with a relative, because many post-ICU patients do not remember the ICU admission and the period immediately afterward. The amount of interviews depends on the point of saturation: when no new analytical constructs can be identified in interviews and focus groups[42]. Four focus group interviews (moderated group discussions with six to ten persons) will be performed with intensivists, ICU nurses, physicians of general wards, and nurses of general wards. They will be recruited from several ICUs, ensuring a representative sample in terms of ICU size.

The questionnaire will be sent to all intensivists in the Netherlands registered with the Dutch Society of Intensive Care (NVIC) to quantify barriers and facilitators identified in the individual and focus group interviews.

Analysis

The individual and focus group interviews will be recorded and transcribed verbatim according to a standardized format. The transcripts will be analyzed and coded by a researcher with qualitative data analysis software (Atlas.ti). The barriers and facilitators will be classified according to analytical categories, based on the framework described in section 'theoretical framework'.

Descriptive statistics will be used to characterize the study sample and to report the results of the interviews, focus groups, and questionnaires. Variance in outcomes from

the questionnaire between different types of hospitals (university and non-university hospitals) and demographic characters (age, gender, and years of experience) will be analyzed.

Phase E: development of an implementation strategy tailored to the barriers and facilitators found
The aim of this phase is to develop a tailored implementation strategy to improve the handover process between the ICU and the general ward.

Study design
To develop the implementation strategy, a complete and detailed plan to change the current way of working and improve quality, the Intervention Mapping (IM) method of Bartholomew will be used. IM is a systematic, iterative six-step process to develop an intervention program, based on theoretical, empirical and practical information[43]. Results of the previous phases (A to D) of this study will provide input for the IM method.
The first step is conducting a problem analysis to describe the healthcare problem, barriers and facilitators to change and the target population (*e.g.*, stage of behavioural change) (phase A, C, D). In step two, specific and feasible goals and change objectives (*e.g.*, what can be changed, what must be changed and who must make the change) are set. In step three, interventions from literature (phase B) are selected that correspond to the change objectives formulated in step two. Step four is the development of a tailored intervention program and pilot testing this program. In step five, the total implementation strategy is developed, including methods and tools for implementation. To evaluate the effects of the developed intervention program and implementation strategy, an effect and process evaluation is conducted in step six[43].

Ethical approval
The study protocol has been presented to the Medical Ethical Committee of the Radboud University Nijmegen Medical Centre (registration number: 2011/460). They declared ethical approval was not required under Dutch National Law.

DISCUSSION

The goal of this study is to obtain more insight into current ICU discharge practices, and into the barriers and facilitators to the implementation of effective ICU discharge interventions. Analysis of the variation between ICU readmission rates and hospital mortality after ICU discharge reveals room for improvement. Improvement may be found in better adherence to effective ICU discharge interventions. In this study, a tailored implementation strategy will be developed based on theoretical and empirical information gathered. Insight into barriers and facilitators to the implementation of ICU discharge interventions is essential in deciding what kinds of activities should be

developed to prevent suboptimal ICU discharges resulting in ICU readmissions and mortality. The knowledge obtained in this study should be used for the further implementation of ICU discharge interventions and can be used for implementation of handover interventions in other healthcare transition settings, such as operating theatre to ICU, operation theatre to general ward, hospital to hospital, or hospital to primary care interface.

This study uses a mixed methods approach, combining qualitative and quantitative research methods, to answer the research questions[42]. Therefore, a complete and in-depth view of the ICU discharge process is ensured, which is necessary for developing a tailored implementation strategy.

The definitions of the patients outcome measures in this study, ICU readmissions and hospital mortality after ICU discharge, are commonly used[16,37]. Therefore, our results can be compared to international literature. The NICE registry, a national database, contains data of almost every ICU patient in the Netherlands; 92% of all ICUs participate. This results in a nearly complete overview of characteristics of the ICU population and quality of ICU care. Also, the collection of data in the NICE database is standardized to ensure its quality.

In phase C, information about adherence is obtained by sending a questionnaire to all Dutch ICUs. A possible limitation of this method is response bias, which will be minimized by sending reminders by e-mail and follow-up calls. In addition, self-reporting adherence may result in overestimation. During the development of the questionnaire, questions that may invite socially desirable answers will be avoided.

The individual interviews and focus groups in phase D might raise questions about generalisability of the results. Therefore, the results of the interviews and focus groups will be quantified by a questionnaire sent to the entire Dutch intensivist population. The results of the questionnaire may also be subject to response bias, which also will be minimized by sending reminders.

The Intervention Mapping method used in phase E has not yet been proven more effective in comparison to other improvement methods. However, it is generally accepted that systematic development of tailored implementation strategies is preferred over intuitively selecting strategies[44]. Based on the results of this study, a tailor-made implementation strategy will be developed to improve the implementation of effective ICU discharge interventions in daily practice. In a subsequent study the cost effectiveness of the developed implementation strategy should be tested.

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Chapter 3

Improving clinical handover between intensive care unit and general ward professionals at intensive care unit discharge: a systematic review

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Intensive Care Medicine 2015;41:589.

ABSTRACT

Purpose: To systematically review and evaluate the effectiveness of interventions in order to improve the safety and efficiency of patient handover between intensive care unit (ICU) and general ward healthcare professionals at ICU discharge.

Methods: PubMed, CINAHL, PsycINFO, EMBASE, Web of Science, and the Cochrane Library were searched for intervention studies with the aim to improve clinical handover between ICU and general ward healthcare professionals that had been published up to and including June 2013. The methods for article inclusion and data analysis were pre-specified and aligned with recommendations outlined in the PRISMA guideline. Two reviewers independently extracted data (study purpose, setting, population, method of sampling, sample size, intervention characteristics, outcome, and implementation activities) and assessed the quality of the included studies.

Results: From the 6,591 citations initially extracted from the six databases, we included 11 studies in this review. Of these, six (55 %) reported statistically significant effects. Effective interventions included liaison nurses to improve communication and coordination of care and forms to facilitate timely, complete and accurate handover information. Effective interventions resulted in improved continuity of care (e.g., reduced discharge delay) and in reduced adverse events. Inconsistent effects were observed for use of care, namely, reduction of length of stay versus increase of readmissions to higher care. No statistically significant effects were found in the reduction of mortality. The overall methodological quality of the 11 studies reviewed was relatively low, with an average score of 4.5 out of 11 points.

Conclusions: This review shows that liaison nurses and handover forms are promising interventions to improve the quality of patient handover between the ICU and general ward. More robust evidence is needed on the effectiveness of interventions aiming to improve ICU handover and supportive implementation strategies.

BACKGROUND

Efficient use of intensive care units (ICUs) has become a top priority of hospitals worldwide as a result of the increased pressure on hospital budgets[1,2]. An optimal patient flow is critical to ensure a high quality of care, given that ICUs are often subject to forward pressure from various internal sources, such as emergency departments or operating theaters[3,4]. Early discharge from the ICU to the general ward is one strategy that can be used to relieve this pressure, but the successful implementation of this strategy requires close cooperation between a variety of healthcare professionals across different clinical settings[4-7].

A patient's discharge from one specialty to another is a high-risk event in the care process and one where poor clinical handover between healthcare professionals leads to preventable errors and adverse events[8,9]. Patients discharged from the ICU are particularly vulnerable to poor handovers due to the complex physiology of their health condition and the significant decrease in monitoring which occurs upon the transfer of these patients to a general ward[10]. These factors are particularly relevant for patients subjected to early discharge policies[7,11].

Despite the availability of professional guidelines for ICU discharge[12-14] the quality of clinical handover practices varies between ICUs[15]. Several studies have identified deficits in the communication, coordination of care and information exchange between ICU and ward healthcare professionals[16-20]. These factors increase the risk of suboptimal ICU discharge and may result in severe adverse events, ICU readmissions, and increased mortality[6,21,22] [6, 21, 22]. In a study conducted in the USA in 2003, Nishi and colleagues reported that 37.3 % of the ICU readmissions within 48 h were potentially preventable[16,23]. Based on available data, it is estimated that a reduction of the readmission rate by 1 %, incorporating an overall mean ICU stay of 6.6 days, could save the U.S. government $1.4 billion per year[1,23-25].

There are several strategies to improve clinical handovers between ambulance crew and emergency department[26,27], between shifts[28,29], and between the hospital and community setting[20,30], as well as postoperative handovers[31]. However, a comprehensive evaluation of the effectiveness of interventions with the aim to improve inter-specialty handovers from the ICU to a general hospital ward is lacking. Niven and colleagues recently reviewed the effect of transition programs for patients discharged from an ICU which focused on post-ICU discharge interventions and excluded studies with a neonatal or pediatric population[9]. Better insight into effective interventions could guide healthcare professionals and policy-makers in the development and implementation of polices aimed at reducing patient mortality rates and costly readmissions[32-34].

The purpose of the study reported here was to systematically review interventions with the aim to improve the quality of patient handover between ICU and general ward healthcare professionals at ICU discharge and to evaluate the overall effects of these interventions.

METHODS

The criteria for article inclusion and data analysis were pre-specified[35], and the protocol followed is given in Appendix 3.1. We followed the recommendations outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement[36].

Data sources and searches

Using specific search terms (for details, see Appendix 3.2), we searched for full-text intervention studies in the following databases: PubMed (including MEDLINE), CINAHL,

PsycINFO, EMBASE, Web of Science, and the Cochrane Library. There were no restrictions based on publication date or language, but the presence of an English abstract was considered to be important. The authors' personal files, references from included studies, and bibliographies of previously published related reviews were also searched to identify additional relevant studies (snowballing)[9,10,37].

Study selection

Two researchers (NS and GH) independently screened the titles and abstracts of all studies identified by the search strategy for their eligibility. A study had to meet all of the following inclusion criteria to be included in the review:

Inclusion of patients or healthcare professionals involved in the handover from the ICU to a step-down unit or ward.

Inclusion of an intervention explicitly describing one or more components that aimed to improve the handover of care between healthcare professionals from the ICU and those of a step-down unit or general ward.

Study design was experimental or quasi-experimental, such as a (cluster) randomized controlled trial, cohort study, or a non-controlled before–after study.

There was at least one process or outcome measure addressing the quality or safety of the discharge.

Studies not available in full-text format were excluded. When the title and abstract did not clearly indicate whether the inclusion criteria were met, a full-text copy was retained and reviewed.

The full text of the potentially relevant studies were retrieved and reviewed by two researchers (NS, GH). The inclusion criteria were applied a second time, and a final set of studies was identified for data extraction. Disagreement on inclusion was resolved by discussion; when no consensus could be reached, a third researcher (MZ) made the final decision.

Data extraction

Data from each study meeting the inclusion criteria were independently extracted by two researchers (NS, GH) using a pre-designed form modified from a checklist developed by Grimshaw and colleagues[38]. The extracted data described the objectives, underlying theory-based concepts, setting, study population, intervention characteristics, implementation activities, process evaluation, and outcome measures. Outcomes were divided into four pre-specified groups by the two researchers separately as: (1) use of care (e.g., ICU readmissions), (2) continuity of care (e.g., information accuracy), (3) adverse events, and (4) mortality. Any disagreement between the two researchers was resolved by discussion.

Quality assessment

The methodological quality was assessed by two researchers (NS, GH) independently. To ensure standardized scoring, we used a standardized form adapted from the Cochrane Effective Practice and Organization of Care (EPOC) Group's Risk of Bias Criteria[39].

Methodological quality was assessed on 11 criteria, including (1) whether studies used random and concealed allocation, (2) whether the studies documented similar baseline characteristics and outcomes between the intervention and control group, (3) whether the studies described a strategy for handling missing data, (4) the likelihood of contamination between study groups, and (5) whether the criteria were free from selective outcome reporting. The decision on whether the criteria were fulfilled was resolved by discussion, or a final decision was made by the third researcher (MZ). Studies were given 1 point for each fulfilled criterion, with a maximum of 11 points. If information was inadequate or missing, the criterion was labeled 'unknown' and no point was given.

Data synthesis and analysis

The study outcomes, such as sample size, intervention characteristics, outcome measures, statistical significance, and direction of the effects observed, were assessed by two researchers (NS, GH) and organized in a tabular form. The interventions were classified by two researchers (NS and GH) based on the definition of continuity of care by Hellesø and colleagues[17]. This classification consists of three elements: (1) the quality of information that is exchanged between healthcare professionals in terms of completeness, accuracy, and clarity; (2) the coordination of care between healthcare professionals in terms of the quality of assessment, planning, and organization of follow-up services and needs; (3) the communication between healthcare professionals in terms of personal and direct contact, accessibility, and timeliness[17,20].

RESULTS

Search results

Our initial search identified 6,591 records (Fig. 3.1), of which 5,268 remained following the exclusion of duplicates. Subsequent screening by title and abstract excluded 5,231 records. The remaining 37 full-text studies were retrieved and reviewed, of which 29 were excluded. Three articles were identified through snowballing. The final set of articles included in the review of consisted of 11 published studies that had undergone full-text extraction[40-50].

Characteristics of included studies

A summary of the characteristics of the 11 studies included in this review is presented in Table 3.1. The study population included neonatal, pediatric, and adult patients and their healthcare professionals. Patients were treated in neonatal, pediatric, general, medical, and/or surgical ICUs situated in various types of hospitals (tertiary, regional, metropolitan, teaching, university/academic, community-teaching, tertiary-referral). Ten studies were single-center studies, and one was conducted across multiple (n = 3) hospitals[47]. The sample size per study ranged from 46 to 4,951 participants for the intervention group and from 53 to 1,872 participants for the control group.

Figure 3.1. Summary of evidence search and selection

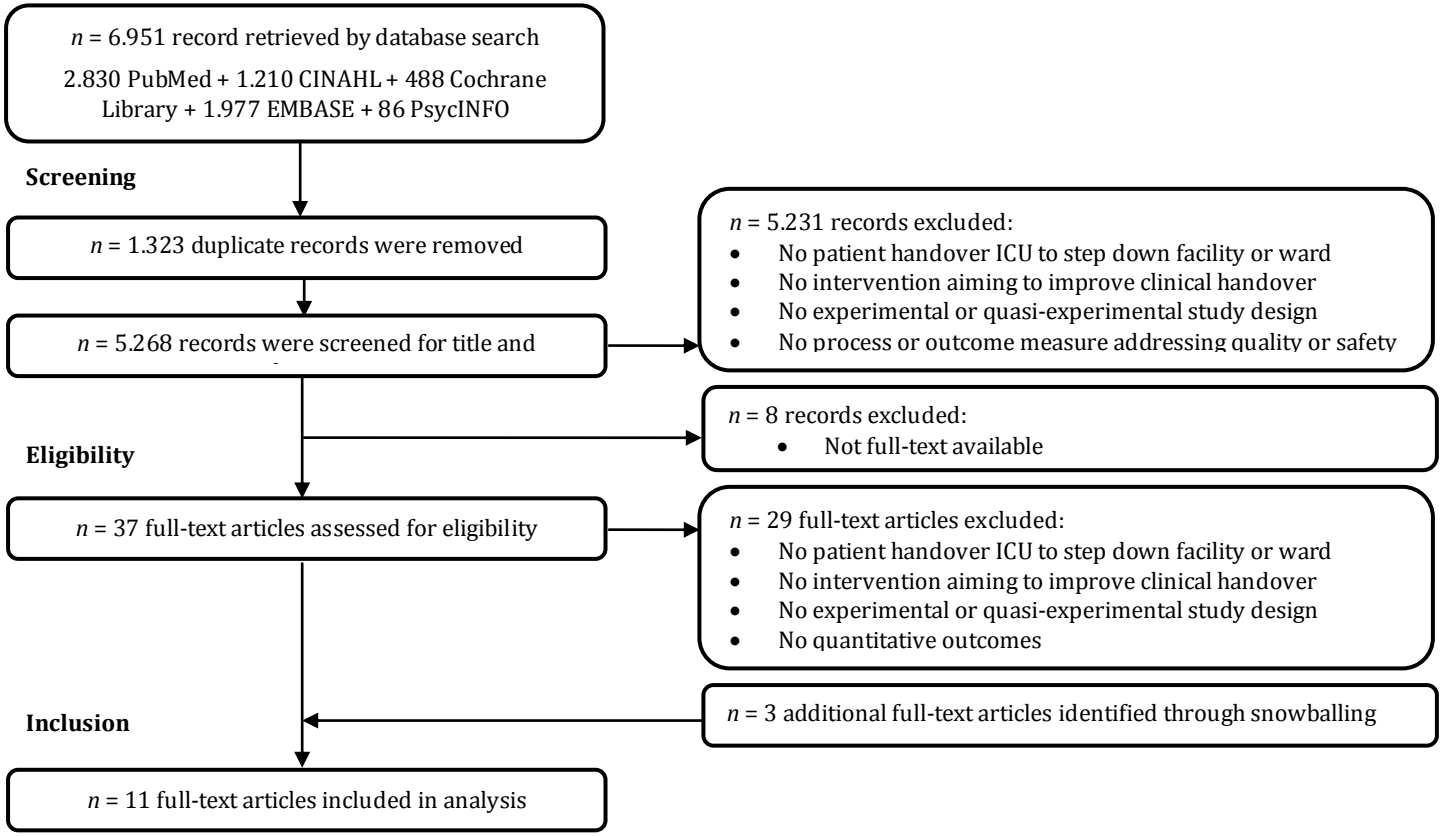

Table 3.1. Characteristics of the 11 studies included in the review

Study, year	Setting	Participants, *n*		Intervention vs. Control	Results			
		Intervention	Control		Outcome	Intervention	Control	p-value
Garcea et al, 2004 [39]	Patients discharged from a ITU or HDU in a general hospital (UK)	833	547	Outreach service vs. usual care	ICU readmission rate, % Readmissions critical care mortality, % (CI) Readmissions in-hospital mortality, % (CI) Readmissions 30-day mortality, % (CI) Total critical care mortality, % Total in-hospital mortality, %	9.5 22.8 (-2.4-30.3) 32.6 (-1.4-33.5) 32.6 (2.8-37.6) 9.3 4.8	9.0 36.7 49.6 53.1 14.3 9.8	NR NR NR NR NR NR
Chaboyer et al, 2006 [40]	Patients discharged from a 13 bed ICU in tertiary referral hospital (Australia)	85	101	Liaison nurse vs. usual care	Discharge delay, >2 h, % Discharge delay, >4 h, % Discharge delay, > 2 h, OR (95% BI) Discharge delay, > 4 h, OR (95% BI)	22.4 14.1 1.0 1.0	49.0 29.0 3.3 (1.7-6.2) 2.5 (1.2-5.2)	<0.001 <0.001 <0.001 <0.05
Caffin et al, 2007 [41]	Patients discharged from a pediatric ICU in an tertiary hospital (Australia)	1,388	1,487	Liaison nurse vs. usual care	Unplanned readmission rate, % (95% CI)	4.8 (3.8-6.1)	5.4 (4.3-6.7)	0.5
Zeigler et al, 2008 [42]	Patients admitted to the surgical or medical ICU and receiving SUP in a 766-bed community-teaching hospital (US)	61	53	Medication reconciliation vs. usual care	Incidence of prolonged SUP upon ICU discharge, % Incidence of prolonged SUP upon surgical ICU discharge, % Incidence of prolonged SUP upon medical ICU discharge, %	79 87 71	85 88 81	0.39 1.00 0.351
Eliott et al, 2008 [43]	Patients admitted to a 12-bed general medical-surgical ICU in a 348-bed metropolitan university teaching hospital (Australia)	943	835	Liaison nurse vs. usual care	Admission median ICU LOS, d (range) Admission mean step-down LOS, d (SD)[a] Admission median hospital LOS, d (range) Admission ICU mortality, % Admission hospital mortality, % Readmissions median ICU LOS, d (range) Readmissions mean step-down LOS, d (SD) Readmissions median hospital LOS, d	2.1 (0-68) 37 (15.5) 11.5 (0.4-68) 14 22 3.0 (0.3-41) NR	2.2 (0-86) 71 (14.2) 12.0 (0.2-230) 15 23 4.0 (0.3-86) NR	0.07 <0.001 0.16 0.69 0.78 0.89 NR

					(range)	35 (6-174)	39 (8-139)	0.59
					Readmissions ICU mortality, %	16	18	0.79
					Readmissions hospital mortality, %	26	35	0.30
Endacott et al, 2010 [44]	Patients discharged from ICU in a 220-bed regional hospital (Australia)	187	201	Liaison nurse vs. usual care	Rate of transfer to higher care, %	23.0	13.9	0.0114
					Crude odds of transfer to higher care (95% CI)	1.88 (1.14-3.09)	1.00	0.014
					Adjusted odds of transfer to higher care (95% CI)	1.82 (1.07-3.09)	1.00	0.028
					Rate of surgical procedure required, %	26.2	15.9	0.022
					Crude odds of surgical procedure required (95% CI)	1.85 (1.09-3.12)	1.00	0.022
					Adjusted odds of surgical procedure required (95% CI)	2.11 (1.24-3.58)	1.00	0.006
					Rate of unexpected death, %	3.2	3.5	0.881
					Crude odds of unexpected death (95% CI)	0.92 (0.30-2.79)	1.00	0.881
Williams et al, 2010 [45]	Discharges from 22-bed general tertiary-referral unit in a metropolitan teaching hospital (Australia)	295	NR	Discharge plan vs. usual care	AE fluid management, %	7	47	NR
					AE respiratory problems, %	16	24	NR
					Probably preventable AEs, %	16	53	<0.001
					Definitely preventable AEs, %	26	12	<0.001
Williams et al, 2010 [46]	Patients discharged from ICUs in 3 tertiary-referral hospitals (Australia)	1,435	1,566	Outreach service vs. usual care	Median ICU LOS, d	1.8	1.9	0.57
					Median LOS admission ICU until hospital discharge, d	10.1	9.8	0.86
					Hospital mortality, %	5.4	5.5	0.86
					Readmissions, %	5.4	5.6	0.83
Palma et al, 2011 [47]	All professionals working in a 74-bed neonatal ICU in a 304-bed academic hospital (US)	46	54	Neonatal-specific electronic handoff tool vs. Microsoft Access-based handoff tool	Perceived accuracy of sign-out document, very accurate, %	37	13	0.0025[b]
					Perceived accuracy of sign-out document, somewhat accurate, %	54	64	
					Perceived accuracy of sign-out document, somewhat inaccurate, %	9	22	
					Perceived accuracy of sign-out document, very inaccurate, %	0	0	
Medlock et al, 2011 [48]	Patients treated in a 30 bed mixed medical-surgical closed format ICU in an academic	4,951	1,872	Policy change and electronic decision	ICU LOS, d	1.9	1.9	0.36
					Mortality, NR	17.81	17.47	0.74
					Initial discharge letter formally completed at time of discharge, %	96.6	11.4	NR

	hospital (the Netherlands)			support and reminders for writing ICU discharge letters vs. usual care	Initial discharge letter for deceased patients completed at time of discharge, % Time to finalize initial discharge letter, median, ds (IQR)	99.7 4 (2-9)	71.6 23 (9-41)	NR <0.0001
Chaboyer et al, 2012 [49]	Patients discharged from a 12-bed general ICU in a 580-bed metropolitan hospital (Australia)	786	1,001	Redesigned discharge process vs. four-step discharge process	Average delay time, h Patient mortality in wards after ICU discharge, % Readmission rate, ≤ 72 h, %	1.0 3.21[c] 2.01[c]	4.6 3.21‡ 2.01‡	NR NR NR

ICU = intensive care unit; ITU = intensive therapy unit; HDU = high dependency unit; LOS = length of stay; SUP = stress ulcer prophylaxis; NR = not reported; AE = adverse events; d = days

[a] ICU step-down days are defined as time spent in the ICU with a nurse-to-patient ratio of 1:2

[b] overall p-value

[c] numbers based on figure [49]

The studies reported various outcomes (Table 3.2), although most studies reported an outcome related to use of care[40,42-45,47,49,50], mortality[40,44,45,47,49,50], and continuity of care[41,48-50]. One study reported adverse events as an outcome measure[46]. Statistical significant improvements were observed in two categories: continuity of care (reduced discharge delay, increased perceived accuracy of information, reduced time to finalize discharge letter)[41,48,49], and preventable adverse events[46]. Inconsistent effects were observed for various aspects of the use of care, namely, reduction of step-down unit length of stay (LOS), increase of transfers to higher care and increase of surgical procedures required[44,45].

Table 3.2 Type of Outcome Measures and Statistical Significance of Effects

Study, year (reference)	Intervention	Outcome types			
		Use of Care	Continuity of Care[a]	Mortality	Adverse Events[b]
Garcea et al, 2004 [39]	Outreach service	✓		✓	
Chaboyer et al, 2006 [40]	Liaison nurse		✓ *		
Caffin et al, 2007 [41]	Liaison nurse	✓			
Zeigler et al, 2008 [42]	Medication reconciliation	✓			
Eliott et al, 2008 [43]	Liaison nurse	✓ *		✓	
Endacott et al, 2010 [44]	Liaison nurse	✓ *		✓	
Williams et al, 2010 [45]	Discharge plan				✓ *
Williams et al, 2010 [46]	Outreach service	✓		✓	
Palma et al, 2011 [47]	Neonatal-specific electronic handoff tool		✓ *		
Medlock et al, 2011 [48]	ICU discharge letter Policy change and electronic decision support	✓	✓ *	✓	
Chaboyer et al, 2012 [49]	Redesigned discharge process	✓	✓	✓	
Total		9	4	7	1

ICU = intensive care unit

[a]Adapted from the definition by Hellesø and colleagues [17] (outcomes that relate to the quality of information, communication, and coordination of care) [20]

[b] Unintended occurrences in handover of care potentially causing harm to the patient [20]

* Outcome with statistically significant effect

Use of care: (unplanned) readmissions; readmissions within 72 hours; ICU length of stay (LOS); step-down LOS; general ward LOS; second ICU LOS; hospital LOS; LOS from admission to ICU to hospital discharge; transfer to higher level care; surgical procedure required; incidence of prolonged stress ulcer prophylaxis

Continuity of care: discharge delay (>2h; >4h); average delay time; initial discharge letter formally completed at time of discharge; initial discharge letter for deceased patient completed at time of discharge; time to finalize initial discharge letter; perceived accuracy of sign-out document (very accurate; somewhat accurate; somewhat inaccurate; very inaccurate)

Mortality: patient mortality in wards after ICU discharge; ICU mortality; critical care mortality; (in-)hospital mortality; 30-day mortality; unexpected death
Adverse events: adverse event (AE) fluid management; AE respiratory problems; probably preventable AEs; definitely preventable AEs

Methodological quality

The overall methodological quality of the studies was relatively low, with an average score of 4.5 points out of 11 possible (Appendix 3.3). In none of the studies was the allocation sequence randomly assigned and the allocation concealed. Six studies did not report similar baseline characteristics[40,42,43,48-50], eight studies did not perform a sample size calculation[40-42,44,45,48-50], and nine studies had no plan for handling missing data[40,42-46,48-50].

Classification and effects of interventions

Table 3 provides an overview of the five types of interventions we identified in the 11 studies, namely, handover forms (n = 3 studies), a redesigned discharge process (n = 1), medication reconciliation (n = 1), liaison nurses (n = 4), and outreach services (n = 2).
In three of the 11 studies, handover forms as a tool for improving the information transferred between ICU and ward were evaluated[46,48,49]. All three studies found a statistically significant improvement in the reduction of adverse events[46] or in continuity of care[48,49]. Williams and colleagues investigated the efficacy of a multidisciplinary form completed predominantly by nurses in combination with a discharge checklist completed by the medical staff. They found that the proportion of preventable adverse events was significantly reduced from 65 to 42 % ($p < 0.001$)[46]. Palma and colleagues implemented the use of a printed sign-out document and sign-out data entry form and reported that the staff perceived these new discharge tools to be significantly more accurate in terms of improving the transfer of information than those used previously ($p = 0.0025$)[48]. Medlock and colleagues investigated the implementation of an electronic discharge letter with a template to support content decisions. The median time to finalize the discharge letter was significantly reduced from 23 [interquartile range (IQR) 9–41) to 4 days (IQR 2–9; $p < 0.0001$)[49].
Four studies examined the effects having an ICU liaison nurse in place to coordinate care and communication between ICU and general ward healthcare professionals[41,42,44,45]. Three of these studies found that a liaison nurse had a statistically significant effect on use of care[44,45] or continuity of care[41]. Chaboyer and colleagues evaluated the effects of liaison nurses who were involved in assessing patients for ICU discharge, coordinating transfer to other wards, and communicating with ward staff[41]. In their study, the liaison nurse assessed ward staff skill-mix and resources, prepared both the ICU and ward for transfer, assessed bed status, and provided clinical support and resources to ward nurses. The authors found that the proportion of patients with a discharge delay of >2 h decreased significantly from 49 to 22 % [odds ratio (OR) 3.3, 95 % confidence interval (CI) 1.7–6.2, $p < 0.001$] and that the proportion with a discharge delay of >4 h decreased significantly from 29 to 14 % (OR 2.5, 95 % CI 1.2–5.2, $p < 0.05$)[41]. Elliott and colleagues implemented the use of liaison nurses who supported the management of discharged

patients with complex care needs. The service involved communicating with ward staff and providing support and bedside education. These authors reported a significant reduction in mean step-down unit LOS from 71 to 37 days[44]. Endacott and colleagues investigated the role of a liaison nurse who visited patients at least daily for the first 3 days after ICU discharge[45]. In their study, the liaison nurse clinically assessed each patient, reviewed the charts, and provided support and informal education to ward staff. The proportion of patients discharged from the ICU who needed transfer to higher care was significantly increased from 14 to 23 % (adjusted OR 1.82, 95 % CI 1.07–3.09, p = 0.014), and the proportion of patients requiring a surgical procedure significantly increased from 16 to 26 % (adjusted OR 1.85, 95 % CI 1.09–3.12, p = 0.022)[45].

Two studies evaluated outreach services, in which activities were used which focused mainly on the follow-up of discharged ICU patients and supporting ward staff. Both studies found that the intervention did not have a statistically significant effect[40,47].

Chaboyer and colleagues implemented a redesigned ICU discharge process, including a handover form to facilitate face-to-face or phone communication between ICU and ward healthcare professionals, a notification from the ward to their ICU counterparts of a specific time they were able to receive the patient, and a daily update to the ward staff summarizing all likely patient discharges ('ICU discharge alert sheet') to better plan patient transfers and coordinate appropriate follow-up[50]. However, these authors reported that their changes to the ICU discharge process did have any statistically significant effects[50].

Zeigler and colleagues examined the use of medication reconciliation[43]. Upon ICU discharge, medication profiles were printed and reviewed by the primary physician and either discontinued or resumed. No statistically significant effects were found on the study outcome, namely, prolonged use of stress ulcer prophylaxis (SUP)[43].

Implementation activities

All of the 11 studies included in the review incorporated specific activities to facilitate the process of implementation of the intervention (Table 3.3). In terms of the implementation of handover forms, activities assessed to be effective were informal instructional sessions, the automatic filling of the handover form with data from the electronic medical record, development of software by the ICU staff, electronic reminders, a top–down directive, and involvement of healthcare professionals in the decision-making process[46,48,49]. Regarding the implementation of liaison nurses, activities assessed to be effective were a clear task description (based on the literature, formats of other hospitals, and experiences of patients, their families, and ICU and ward nurses), correct qualifications (experienced ICU or critical care nurse), provision of training to standardize the tasks carried out by liaison nurses, and encouraging ward staff to consult a liaison nurse if in doubt[41,44,45].

Table 3.3 Overview of Intervention Characteristics.

Study, year (reference)	Intervention	Relevant actions	Key players	Classification			Implementation activities	Significant effects
				Information	Coordination	Communication		
Garcea et al, 2004 [39]	Outreach service	The outreach team consists of two senior grade nurses and a consultant nurse specialist, and a consultant intensivists acts as lead clinician; follow-up of discharges on at least a daily basis; act as liaison between ward-based staff and critical care intensivists; ward staff are encouraged to refer any patients of concern directly to the outreach team for review.	Outreach team, ward staff		✓	✓	Experienced nurses	No
Chaboyer et al, 2006 [40]	Liaison nurse	Assessment of patients for transfer to the ward, with major focus being the coordination of ICU patient transfer and liaison with ward staff; communicating with ward staff; assessing ward staff skill-mix and resources; assessing bed status; providing clinical support, resources and education to ward nurses.	Liaison nurse, ICU staff, ward staff		✓	✓	Role development using literature review and focus groups interviews	Yes
Caffin et al, 2007 [41]	Liaison nurse	Follow-up of patients discharged from PICU within the last 48 hours; advanced nurse consultancy and education; improve communication between PICU staff and staff on the wards.	Liaison nurse, ICU staff, ward staff		✓	✓	Role development using existing guidelines; experienced and post graduate nurse	No
Zeigler et al, 2010 [42]	Medication reconciliation	Medication profiles are printed and reviewed by the primary physician; existing medications are ordered to be either discontinued or resumed.	Primary physician	✓			Educational sessions; web-based training module; presentations; one-on-one communication	No
Eliott et al,	Liaison nurse	Communicating with ward staff and providing	Liaison nurse,			✓	Experienced nurses	Yes

2008 [43]		support and bedside education as required.	ward staff					
Endacott et al, 2010 [44]	Liaison nurse	Post discharge visit to patient involving clinical assessment and chart review; support and informal education to staff.	Liaison nurse, ward staff			✓	Experienced nurse with specialist critical care qualification; additional training for liaison nurse to standardize intervention	Yes
Williams et al, 2010 [45]	Discharge plan	The discharge plan is a multidisciplinary form used as a tool to facilitate the handover and provide information on ongoing care needs; nursing information includes a summary of the patient's stay in the ICU, social history, status, and care that the patient is receiving on discharge; checklist that includes whether the handover to the specialty team is documented, fluid or completed, and discharge summery written in the medical record.	ICU staff, ward staff	✓			Intervention development by users; education for ICU and ward staff	Yes
Williams et al, 2010 [46]	Outreach service	Assessment before discharge from ICU; follow-up visits by critical care nursing specialists, who review and assess patients before and after ICU discharge; education and clinical support of general care staff; protocol for processes undertaken at bedside and actions taken in response.	Outreach team, ward staff		✓	✓	Job description and selection criteria used in recruitment; 2-week orientation period for outreach nurses; newsletter, personal communication and education sessions to inform hospital staff about study.	No
Palma et al, 2011 [47]	Neonatal-specific electronic handoff tool	Printed neonatal sign-out document; neonatal sign-out data entry form; sign-out document is organized by bed location and is populated automatically; patient description, a systems-based summary of active medical issues and ongoing care, a to-do list are entered as free text on sign-out entry form.	ICU staff, ward staff	✓			Instructions of handoff tool were emailed to users; training for pediatric residents; informal instructional sessions were provided to staff	Yes
Medlock et al, 2011 [48]	ICU discharge letter Policy change	A letter as a transfer note; a copy of the completed initial letter goes with the patient at the time of ICU discharge; assignment of	ICU medical staff	✓	✓	✓	New software was developed by users; consensus about the software was reached among	Yes

	and electronic decision support	responsibility is an automatic process; provision of decision support, through automatic copying of important content from the patient record to the letter.					clinicians by round table discussion; the software was tested and integrated in existing data management system	
Chaboyer et al, 2012 [49]	Redesigned discharge process	Handover sheet was used to guide phone handover and face-to-face handover, and as documentation for ward staff to record information and provide a basis for future reference by ward staff; notification by ward staff of a specific time they could receive the patient; a daily 'ICU discharge alert sheet' summarizing all likely patient discharges.	ICU staff, ward staff	✓	✓	✓	Appointing a well-known and respected nursing leader as a change agent; handover sheet developed by ward charge nurses; education by change agent for staff; poster, bedside summary as memory aids and to facilitate face-to-face handover; ongoing support for ICU and ward staff; nursing leaders from ICU and ward endorsed new process	No

ICU = intensive care unit; PICU = pediatric intensive care unit, LN = liaison nurse; ICU = intensive care unit; NNP = neonatal nurse practitioner

DISCUSSION

In this review we have reported the effects of interventions focusing on improving clinical handovers between ICU and ward healthcare professionals at the time of patient discharge from the ICU. After an extensive search process of six databases and subsequent selection of relevant reports, we ultimately only included 11 studies in our review, which indicates that very few studies on this specific topic have been performed. A statistically significant effect on quality of handover was observed in six of these studies (55 %). Effective interventions included: (1) implementation of liaison nurses to improve the communication and coordination of care between ICU and ward healthcare professionals and (2) handover forms to facilitate the timely handover of complete and accurate clinical information from ICU to ward healthcare professionals. Interventions were effective in improving the continuity of care and reducing preventable adverse events. The effects found for the use of care were inconsistent; a decrease in step-down unit LOS was observed[44], as well as an increase in transfers to higher care and in the requirement for surgical procedures[45].

In accordance with our review, two recent studies report that liaison nurses can be a useful tool for bridging coordination gaps between healthcare settings[20,30]. In the studies included in this review, factors facilitating the implementation of a liaison nurse were a clear task description, 'casting' the right person based on experience, and encouragement of ward staff to consult a liaison nurse[41,44,45]. The literature also highlights a number of factors considered to be important for proper functioning of a liaison nurse: (1) that the liaison nurse be able to personalize his/her role as an ICU liaison nurse; (2) that the liaison nurse be able to gain the respect of ICU and general ward colleagues; (3) that ward staff view the implementation of a liaison nurse as a collaborative and supportive effort—and not as an intrusion in their ward[5] [5].

Published studies also show that poor information transfer is a common patient safety issue in all types of handover settings[51-53]. Various reviews have reported the effectiveness of standardizing tools (e.g., standardized handoff tools, computerized handoff tools) to improve information transfer[30,54,55] and, possibly, quality of care as well. In accordance with these studies, we found that the use of an ICU discharge form is an effective intervention by which to standardize information transfer and communication between ICU and ward healthcare professionals. It is interesting that the aims of the studies on information transfer focused on improving written communication [*e.g.*, improving the situation background assessment recommendation (SBAR) checklist or collaboration between ICU and ward healthcare staff with team training], even though culture, team climate and verbal communication have been identified as important factors for inadequate patient handover[56].

Assessment of the 11 studies included in our systematic review reveals that a timely transfer of the patient together with accurate and complete information on the patient being transferred from the ICU to the ward are the specific aspects of handover which most readily show a change following interventions. Continuity of care in terms of reduced discharge delay and improved accuracy of discharge information was improved

in three out of four studies investigating this outcome measure. However, whether this resulted in any beneficial clinical outcome beyond a better recording of data is unclear. Mortality rates were not improved in any of the seven studies evaluating mortality as an outcome measure. Evidence showing a reduction in ICU readmission or ICU LOS was limited; only one study found evidence for a reduction in step-down unit LOS[44].

The limitations of our review relate to the nature of the interventions and the study designs used. Similar to other reviews on patient handover, most interventions consisted of a complex set of activities. Most studies contain specific activities that have not been studied outside the set of activities used in the intervention. These aspects hinder an appropriate and direct evaluation of the interventions[20,57]. Second, the poor methodological quality of most of the included studies makes it difficult to draw firm conclusions on the effectiveness of individual interventions. Single-institution evaluations with an observational design, *i.e.*, non-controlled before–after design, dominated the studies we identified. In general, observational studies overestimate the effect. Third, the studies were characterized by significant heterogeneity for both interventions and outcome, making it impossible to perform a meta-analysis. Heterogeneity has been acknowledged to be a common limitation in the clinical handover literature[9,20,54,57]. Fourth, the classification of interventions into information, coordination, and communication categories was strictly based on the description of the intervention provided in the studies. Although interventions were independently classified by two researchers, the classification may be subject to bias due to minimal or unclear intervention descriptions. Fifth, we excluded non-published studies and non-full-text studies, which may have increased the risk of publication bias, i.e., the risk that this review overestimates or underestimates the true intervention effects. Moreover, we could not assess the risk of publication bias using a funnel plot due to the heterogeneity in outcome measures and the small number of studies found[39].

Despite handover being an important topic for the World Health Organization[58], and national government agencies, such as the Joint Commission, this systematic review highlights the absence of evidence on how to improve patient handovers between the ICU and general wards. Several reasons for the lack of effects have been described: use of an inappropriate intervention in relation to the underlying healthcare problem[43], measurement of inappropriate outcomes[50], and suboptimal research population, such as low mortality rate at baseline[47]. The lack of effects may also be influenced by limited actual exposure of healthcare professionals to the intervention and implementation activities[59]. These reasons reflect the difficulty of demonstrating the effectiveness of complex quality improvement interventions, as has been mentioned in several publications[60-62].

Our hope is that this systematic review will act as a stimulus to gather more evidence on the interventions described in the 11 studies included in the review, as well as interventions evaluated in other settings, such as a shared electronic information exchange system to improve handover between hospital and primary healthcare providers[63]. The implementation of interventions for which insufficient evidence is available carries the burden of potentially wasting valuable resources, which may

increase the reluctance of clinicians to implement other quality improvement initiatives[64]. We recommend that researchers and clinicians considering to conduct an evaluation of an improved handover process use robust designs to strengthen the quality of evidence on this topic. Randomized controlled trials are often impossible to conduct due to difficulties in blinding and concealment of allocation. Cluster randomized controlled trials pose difficulties in terms of sample size and obtaining a uniform control group. Other rigorous study designs, such as an interrupted time-series or a controlled before-and-after study, are good alternatives and are more feasible in practice[65]; however, they are associated with a greater risk of bias. Objective outcome or performance measures, such as readmission rate or mortality rate, are the ideal parameters for measuring effectiveness, but due to low incidence, it is hard to reach statistical significance. Process measures can be used to gain more insight in the processes leading to improvement in the outcome measures[61].

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APPENDICES

Appendix 3.1. Protocol systematic review

Objectives:
To systematically review interventions that aimed to improve the quality of patient handover between ICU and general ward professionals at ICU discharge and to evaluate the overall effects of these interventions.

Methods:
Criteria for selecting studies for this review
Types of studies:
Randomized controlled trials (RCTs)
Non-randomized controlled trials (NRCTs)
Controlled before-after (CBA) studies
Interrupted time series (ITS) and repeated measure studies
Historically controlled studies
Case-control studies
Cross-sectional studies
Stepped wedge designs (SWD)
Non-controlled before-after studies
Community intervention trial
Cohort study with and without control
Case series (uncontrolled longitudinal studies)

Types of participants:
ICU patients discharged to an in-hospital care facility; no age limits (including neonatal and pediatric ICUs); Healthcare professionals involved in the handover of patients from the ICU to an in-hospital care facility
Types of interventions:
An intervention explicitly describing one or more components that aim to improve the handover of care between ICU and step down unit or ward
Types of outcome measures:
Studies will be selected on the measures they use to quantify the effect of the intervention. We will include outcome measures, for example hospital mortality, readmission rate, adverse (drug) events, etc., and process measures, for example accuracy of discharge summary, number of (drug) omissions, knowledge professionals, etc. These measures can be on patient level, the level of the healthcare professional, or on system level.

Search methods for identification of studies
Databases: PubMed (including MEDLINE), CINAHL, PsycINFO, EMBASE, Web of Science, and the Cochrane Library.
Full-text articles
No language restriction; English abstract available
No exclusion based on publication date

Data collection and analysis
See Labeling protocol title and abstract scan
See Data abstraction form
See Quality assessment form

Labeling protocol title and abstract scan
0 = inclusion
1 = no patient discharge from ICU to step down unit or ward
2 = no intervention explicitly describing one or more components that aim to improve the handover of care between ICU and step down unit or ward
3 = no experimental or quasi-experimental study design
4 = no process or outcome measure(s)
d = article needs to be discussed

Appendix 3.2. Search Strings, by Database

Pubmed (∞ - 2013)

Search Strategy

(((((((Critical Care [Mesh]) OR Intensive Care Units [Mesh]) OR critical care* [tiab]) OR intensive care* [tiab]) OR special care unit* [tiab])) AND ((((((((((Patient Discharge [Mesh]) OR Patient Transfer [Mesh]) OR discharg* [tiab]) OR transfer* [tiab]) OR transition* [tiab]) OR handover* [tiab]) OR hand over* [tiab]) OR handoff*[tiab]) OR hand off*[tiab]) OR signout*[tiab]) OR sign out*[tiab])) AND ((((((((((((((Randomized Controlled Trial [PT]) OR Controlled Clinical Trial [PT]) OR Evaluation Studies [PT]) OR Intervention Studies [Mesh]) OR Comparative Study [PT]) OR time series [tiab]) OR before after [tiab]) OR (((before and after [tiab])))) OR random [tiab]) OR randomized [tiab]) OR randomised [tiab]) OR compare [tiab]) OR compared [tiab]) OR comparison [tiab]) OR effect [tiab]) OR effects [tiab])) AND ((((((((((((((((((intervention* [tiab]) OR tool* [tiab]) OR strategy [tiab]) OR strategies [tiab]) OR program* [tiab]) OR instrument* [tiab]) OR guideline* [tiab]) OR protocol [tiab]) OR protocols [tiab]) OR liaison* [tiab]) OR reconciliation [tiab]) OR checklist* [tiab]) OR policy [tiab]) OR policies [tiab]) OR standard [tiab]) OR standards [tiab]) OR (((planned [tiab]) OR planning [tiab]) AND discharge*[tiab])) OR ((((letter* [tiab]) OR summar* [tiab]) OR note* [tiab]) AND discharge* [tiab])) OR ((((letter* [tiab]) OR summar* [tiab]) OR note* [tiab]) AND transfer* [tiab])) OR (((process* [tiab]) OR practice* [tiab]) AND redesign* [tiab]))

Hits: 2830

CINAHL (∞ - 2013)

Search Strategy

((MH "Critical Care+" OR MH "Intensive Care Units, Neonatal" OR MH "Intensive Care Units+" OR MH "Intensive Care Units, Pediatric+" OR MH "Intensive Care, Neonatal+" OR MH "Neonatal Intensive Care Nursing" OR AB intensive care* OR AB special care unit* OR AB critical care*) AND (MH "Patient Discharge+" OR MH "Transfer, Discharge" OR MH "Hand Off (Patient Safety)+" OR AB discharg* OR AB transfer* OR AB transition* OR AB handover* OR AB hand over* OR AB handoff* OR AB hand off* OR AB signout* OR AB sign out*) AND (MH "Comparative Studies" OR MH "Quasi-Experimental Studies+" OR MH "Quantitative Studies" OR MH "Qualitative Studies+" OR MH "Experimental Studies+" OR MH "Triple-Blind Studies" OR MH "Static Group Comparison" OR MH "Solomon Four-Group Design" OR MH "Single-Blind Studies" OR MH "Pretest-Posttest Design+" OR MH "One-Shot Case Study" OR MH "Nonrandomized Trials" OR MH "Factorial Design" OR MH "Double-Blind Studies" OR MH "Community Trials" OR MH "Clinical Trials+" OR AB time series OR AB before after OR AB before and after OR AB random OR AB randomized OR AB compare OR AB compared OR AB comparison OR AB effect OR AB effects) AND (MH "Practice Guidelines" OR MH "Practice Guidelines" OR MH "Protocols+" OR MH "Nurse Liaison" OR MH "Medication Reconciliation" OR MH "Checklists" OR AB intervention* OR AB tool* OR AB strategy OR AB strategies OR AB program* OR AB instrument* OR AB guideline* OR AB protocol OR AB protocols OR AB liaison* OR AB reconciliation OR AB reconciliation OR AB checklist* OR AB policy OR AB policies OR AB standard OR AB standards OR (AB planned OR AB planning AND AB discharge*) OR (AB letter* OR AB summar* OR AB note* AND AB discharge*) OR (AB letter* OR AB summar* OR AB note* AND AB transfer*) OR (AB practice* OR AB process* AND AB redesign*)))

Hits: 1210

PsycInfo (∞ - 2013)

Search Strategy

(intensive care/ OR critical care$ OR intensive care$ OR special care unit$) AND (client transfer/ OR (patient$ AND discharge$) OR (patient$ AND transfer$) OR (patient$ AND transition$) OR (care$ AND transition$) OR handover$ OR hand over$ OR handoff$ OR hand off$ OR signout$ OR sign out$) AND (clinical trials/ OR time series OR before after OR before and after OR random OR randomi?ed OR compare OR compared OR comparison OR effect OR effects) AND (((process$ OR practice$) AND redesign$) OR ((letter$ OR summar$ OR note$) AND transfer$) OR ((letter$ OR summar$ OR note$) AND discharge$) OR ((planned OR planning) AND discharge$) OR (standard AND (discharge OR transfer OR

transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (standards AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (policy AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (policies AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (checklist$ AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (reconciliation AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (liaison$ AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (protocol AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (protocols AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (guideline$ AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (instrument AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (program$ AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (strategy AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (strategies AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (tool$ AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)) OR (intervention$ AND (discharge OR transfer OR transition OR handover OR hand over OR handoff OR hand off OR signout OR sign out)))
Hits: 86

Cochrane Library (∞ - 2013)

Search Strategy

((MeSH descriptor: [Critical Care] explode all trees OR MeSH descriptor: [Intensive Care Units] explode all trees OR "critical" next care*:ti,ab,kw OR "intensive" next care*:ti,ab,kw OR "special" next "care" next unit*:ti,ab,kw) AND (MeSH descriptor: [Patient Discharge] explode all trees OR MeSH descriptor: [Patient Transfer] explode all trees OR discharg*:ti,ab,kw OR transfer*:ti,ab,kw OR transition*:ti,ab,kw OR handover*:ti,ab,kw OR "hand" next over*:ti,ab,kw OR handoff*:ti,ab,kw OR "hand" next off*:ti,ab,kw OR signout*:ti,ab,kw OR "sign" next out*:ti,ab,kw) AND (randomized next "controlled trial":pt OR "controlled clinical trial":pt OR "evaluation studies":pt OR MeSH descriptor: [Intervention Studies] explode all trees OR "comparative study":pt OR "time series":ti,ab,kw OR "before after":ti,ab,kw OR "before and after":ti,ab,kw OR "random":ti,ab,kw OR "randomised":ti,ab,kw OR "randomized":ti,ab,kw OR "compare":ti,ab,kw OR "compared":ti,ab,kw OR "comparison":ti,ab,kw OR "effect":ti,ab,kw OR "effects":ti,ab,kw) AND (intervention*:ti,ab,kw OR tool*:ti,ab,kw OR "strategy":ti,ab,kw OR "strategies":ti,ab,kw OR program*:ti,ab,kw OR instrument*:ti,ab,kw OR guideline*:ti,ab,kw OR "protocol":ti,ab,kw OR "protocols":ti,ab,kw OR liaison*:ti,ab,kw OR "reconciliation":ti,ab,kw OR checklist*:ti,ab,kw OR "policy":ti,ab,kw OR "policies":ti,ab,kw OR "standard":ti,ab,kw OR "standards":ti,ab,kw OR (("planned":ti,ab,kw OR "planning":ti,ab,kw) AND discharge*:ti,ab,kw) OR ((letter*:ti,ab,kw OR summar*:ti,ab,kw OR note*:ti,ab,kw) AND discharge*:ti,ab,kw) OR ((letter*:ti,ab,kw OR summar*:ti,ab,kw OR note*:ti,ab,kw) AND transfer*:ti,ab,kw) OR ((process*:ti,ab,kw OR practice*:ti,ab,kw) AND redesign*:ti,ab,kw)))
Hits: 488

EMBASE (∞ - 2013)

Search Strategy

((critical care/ OR intensive care unit/ OR critical care$.ti,ab,kw. OR intensive care$.ti,ab,kw. OR special care unit$.ti,ab,kw.) AND (patient discharge/ OR patient transfer/ OR (patient.ti,ab,kw. AND discharge$.ti,ab,kw.) OR (patient.ti,ab,kw. AND transfer$.ti,ab,kw.) OR (patient.ti,ab,kw. AND transition$.ti,ab,kw.) OR (transition$.ti,ab,kw. AND care.ti,ab,kw.) OR handover$.ti,ab,kw. OR hand over$.ti,ab,kw. OR handoff$.ti,ab,kw. OR hand off$.ti,ab,kw. OR signout$.ti,ab,kw. OR sign out$.ti,ab,kw.) AND (((process$.ti,ab,kw. OR practice$.ti,ab,kw.) AND redesign$.ti,ab,kw.) OR ((letter$.ti,ab,kw. OR

summar$.ti,ab,kw. OR note$.ti,ab,kw.) AND transfer$.ti,ab,kw.) OR ((letter$.ti,ab,kw. OR summar$.ti,ab,kw. OR note$.ti,ab,kw.) AND discharg$.ti,ab,kw.) OR ((discharg$.ti,ab,kw. OR transfer$.ti,ab,kw. OR transition$.ti,ab,kw. OR handover.ti,ab,kw. OR hand over.ti,ab,kw. OR handoff.ti,ab,kw. OR hand off.ti,ab,kw. OR signout.ti,ab,kw. OR sign out.ti,ab,kw.) AND (standard.ti,ab,kw. OR standards.ti,ab,kw. OR policy.ti,ab,kw. OR policies.ti,ab,kw. OR checklist$.ti,ab,kw. OR reconciliation.ti,ab,kw. OR liaison$.ti,ab,kw. OR protocol.ti,ab,kw. OR protocols.ti,ab,kw. OR guideline$.ti,ab,kw. OR instrument$.ti,ab,kw. OR program$.ti,ab,kw. OR strategy.ti,ab,kw. OR strategies.ti,ab,kw. OR tool$.ti,ab,kw. OR intervention$.ti,ab,kw.)) AND (randomised controlled trial/ OR controlled clinical trial/ OR controlled clinical trials/ OR evaluation studies/ OR intervention studies/ OR comparative studies/ OR time series.ti,ab,kw. OR before after.ti,ab,kw. OR (before and after).ti,ab,kw. OR random.ti,ab,kw. OR randomi?ed.ti,ab,kw. OR compare.ti,ab,kw. OR comparison.ti,ab,kw. OR effect.ti,ab,kw.))
Hits: 1977

Appendix 3.3. Quality Rating of Included Studies

Study, Year (reference)	Study design	Eligibility criteria described	Sample size calculation	Allocation sequence random	Allocation concealed	Baseline outcomes similar	Baseline characteristics similar	Plan for missing data	Outcomes assessed blind	No contamination	No selective outcome reporting	No other bias	Score (1-11)
Garcea et al, 2004 [39]	NCBA, retrospective	Yes	No	No	No	No	U	No	Yes	Yes	No	No	3
Chaboyer et al, 2006 [40]	NRBD, prospective	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	7
Caffin et al, 2007 [41]	NCBA, prospective	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	4
Zeigler et al, 2008 [42]	NCBA, retrospective	Yes	Yes	No	No	No	U	No	Yes	Yes	Yes	No	5
Eliott et al, 2008 [43]	NCBA	Yes	No	No	No	No	Yes	No	Yes	No	Yes	No	4
Endacott et al, 2010 [44]	CC	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	No	5
Williams et al, 2010 [45]	NCBA	Yes	Yes	No	No	No	Yes	No	No	Yes	Yes	No	5
Williams et al, 2010 [46]	NCBA, retrospective and prospective	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No	7
Palma et al, 2011 [47]	NCBA, prospective	Yes	No	No	No	U	U	No	No	Yes	Yes	No	3
Medlock et al, 2011 [48]	NCBA, prospective	Yes	No	No	No	No	No	No	Yes	Yes	Yes	No	4
Chaboyer et al, 2012 [49]	NCBA, retrospective	U	No	No	No	No	No	No	Yes	Yes	Yes	No	3

NCBA = non-controlled before-after study; NRBD = nonrandomized block design; CC = case-control study; U = unclear

Chapter 4

Variation in rates of ICU readmissions and post-ICU in-hospital mortality and their association with ICU discharge practices

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Submitted

ABSTRACT

Introduction: Variation in intensive care unit (ICU) readmissions and in-hospital mortality after ICU discharge may indicate potential for improvement and could be explained by the ICU discharge practices. Our objective was threefold: (1) describe variation in rates of ICU readmissions within 48 hours and post-ICU in-hospital mortality, (2) describe ICU discharge practices in Dutch hospitals, and (3) study the association between rates of ICU readmissions within 48 hours and post-ICU in-hospital mortality and ICU discharge practices.

Methods: We analysed data on 42,040 admissions to 82 (91.%) Dutch ICUs in 2011 from the Dutch National Intensive Care Evaluation (NICE) registry to describe variation in standardized ICU readmission and post-ICU mortality rates using funnel-plots. We send a questionnaire to all Dutch ICUs. 75 ICUs responded and their questionnaire data could be linked to 38,498 admissions in the NICE registry. Generalized estimation equations analyses was used to study the association between ICU readmissions and post-ICU mortality rates and the identified discharge practices, i.e. (1) ICU discharge criteria; (2) bed managers; (3) early discharge planning; (4) step-down facilities; (5) medication reconciliation; (6) verbal and written handover; (7) monitoring of post-ICU patients; and (8) consulting ICU nurses. In all analyses, the outcomes were corrected for patient-related confounding factors.

Results: The standardized rate of ICU readmissions varied between 0.14 and 2.67 and 17% of the hospitals fell outside the 95% control limits and 3% outside the 99.8% control limits. The standardized rate of post-ICU mortality varied between 0.07 and 2.07 and 14% of the hospitals fell outside the 95% control limits and 4% outside the 99.8% control limits. We could not demonstrate an association between the eight ICU discharge practices and rates of ICU readmissions or post-ICU in-hospital mortality. Implementing a higher number of ICU discharge practices was also not associated with better patient outcomes.

Conclusions: We found both substantial variation in patient outcomes and variation in ICU discharge practices between ICUs. However, we found no association between discharge practices and rates of ICU readmissions or post-ICU mortality. Further research is necessary to find factors, which may influence these patient outcomes, in order to improve quality of care.

BACKGROUND

Intensive care unit (ICU) readmissions pose an important clinical problem because they are associated with patient harm, inefficiencies and higher costs[1-4]. Patients readmitted to the ICU experience more adverse events, with in-hospital mortality rates up to six

times higher than non-readmitted patients[5]. Readmitted patients reduce ICU bed availability and it is possible that ICU facilities could be used more efficiently if ICU readmissions could be prevented[1-4].

Risk factors for ICU readmission and in-hospital mortality following ICU discharge include patient characteristics, such as age, co-morbidities and severity of illness[5,6], and organisational factors, such as discharge time and the availability of step-down facilities[5-8]. A substantial amount of variation in patient outcomes between hospitals may be explained by the organisation of the ICU discharge process[9], which consists of four essential components: decision making, planning and preparation, patient transport and follow-up. The ICU discharge process is a complex process in which many healthcare professionals are involved[10]. Deficits in communication, coordination of care, and information exchange between ICU and general ward professionals[11-13] may increase the risk of a suboptimal handover, severe adverse events, ICU readmissions and mortality[14]. Patients discharged from the ICU are particularly vulnerable to poor handovers due to the complicated physiology[15] and the substantial decrease in monitoring when these patients are transferred from the ICU to a general ward[16,17].

Several methods and instruments are available which aim to improve the quality of the discharge of ICU patients to general wards, such as a liaison nurse and handover forms[18]. Evidence of the effectiveness of these interventions, however, is limited[18,19] and the actual use of ICU discharge practices vary between ICUs[20].

Variation in ICU readmissions and in-hospital mortality after ICU discharge between hospitals may indicate potential for improvement and be explained by the ICU discharge practices which have been implemented. Insight into associations between ICU discharge practices and patient outcomes can provide evidence for professionals on ways to improve their ICU discharge process, and possibly, reduce adverse patient outcomes.

The aims of this study were: (1) to describe variation in rates of ICU readmissions within 48 hours and post-ICU in-hospital mortality in individual hospitals; (2) to describe current ICU discharge practices in Dutch hospitals; and (3) to study the association between ICU discharge practices and rates of ICU readmissions within 48 hours and post-ICU in-hospital mortality. We hypothesized that the implementation of ICU discharge practices would be associated with lower rates of ICU readmissions and lower rates of post-ICU in-hospital mortality.

METHODS

The design of the study was pre-specified and published[21].

Patient data and outcomes and ethical approval

The Dutch National Intensive Care Evaluation (NICE) registry collects demographic, physiological, clinical and organizational data from ICUs. To ensure that the data are of a high quality, ICU employees are trained in how to score patients, the data are checked before being read into the database, and data quality audits are carried out[22].

We used data from the NICE registry on ICU admissions, for reasons other than cardiac surgery, between 1st January and 31st December 2011. We did not examine admissions following cardiac surgery, because cardiac surgery is only performed in a small number of hospitals in the Netherlands and these patients have a low risk of ICU readmission or post-ICU in-hospital mortality[1,23]. We excluded admissions, in which the patient died during the initial ICU admission or was discharged from the ICU and hospital simultaneously, because these patients were not at risk for ICU readmission or post-ICU in-hospital mortality. We also excluded admissions not fulfilling the Acute Physiology and Chronic Health Evaluation (APACHE) IV inclusion criteria[23] and with missing data on type of admission, reason for discharge, APACHE physiology score, APACHE reason for admission or discharge location (Appendix 4.1).
We defined an initial ICU admission as a patient's first ICU admission within a single hospital stay and an ICU readmission as the first ICU readmission within 48 hours of the initial ICU discharge, but within the same hospital stay. We choose a time frame of 48 hours, as readmissions within this period have a stronger relationship with ICU interventions, such as mechanical ventilation, and discharge circumstances, than later readmissions[24]. We defined post-ICU in-hospital mortality as the death of the patient after the initial ICU admission ended, but before he or she was discharged from the hospital.

Ethical approval

We used an anonymized data set for this study[25-27]. We presented the study protocol[21] to the medical ethical committee of the Radboud University Medical Center (registration number: 2011/460). This committee stated that ethical approval was not required under Dutch National Law.

ICU discharge practices

Members of an expert panel, consisting of one internal medicine consultant, two intensive care consultants and two researchers, selected eight ICU discharge practices described in scientific literature and clinical guidelines[18,19,28-36] to examine in this study. We present these eight practices in Table 4.1. They were the use of: (1) ICU discharge criteria[29,30]; (2) a bed manager[31,32]; (3) early discharge planning[33] (4) step-down facilities[28,30]; (5) medication reconciliation[32,34]; (6) verbal and written handover[28,30,32]; (7) monitoring of post-ICU patients[36]; and (8) consulting ICU nurses[35]. We extracted data on the use of step-down facilities from the NICE registry. We collected data on the use of the other seven ICU discharge practices using an online questionnaire (Appendix 4.2), sent to all Dutch ICUs in May 2012. We sent reminders after nine days and after three weeks and contacted the non-responding ICUs by telephone a month after initially sending out the questionnaire. We transformed the data on the use of the eight discharge practices into dichotomous variables to indicate the presence or absence of a discharge practice on a specific ICU (Appendix 4.3). We summed the eight dichotomous variables into a combined practice score, representing the number of discharge practices incorporated into the discharge process in each ICU.

Table 4.1. ICU discharge practices

Discharge practice	Description
Discharge criteria	the usage of set criteria when making the decision to discharge a patient from the ICU
Bed manager	nurse or physician managing bed availability in ICU and step-down facilities
Early discharge planning[a]	starting with planning a discharge at least 24 hours before the transfer of the patient to the ward
Step-down facilities	beds with less monitoring and a lower nurse-patient ratio than ICU beds, but more monitoring and a higher nurse-patient ratio then ward beds.
Medication reconciliation[a]	creating an actual medication overview of current medications, (temporarily stopped) home medication, and information about allergies. Home medication and allergy information is checked with the patient or relatives.
Verbal and written handover[b]	oral and written information transfer by nurses, and oral and written information transfer by physicians
Monitoring of post-ICU patients	patients discharged from the ICU are visited on the ward and evaluated by ICU personnel
Consulting ICU nurses	an ICU nurse is 24/7 available for questions and assistance on the ward

[a] We asked what percentage of patients received early discharge planning or medication reconciliation. If more than 50% of the patient received the intervention, the ICU was deemed to have implemented this practice.

[b] The ICU was deemed to have implemented this practice if all four forms of communication at discharge were performed: oral nursing handover, written nursing handover, oral medical handover, and written medical handover.

Statistical analyses

We calculated the standardised readmission and post-ICU mortality rates for each hospital by dividing the observed number of readmissions or deaths by the expected number of readmissions or deaths. The expected number of readmissions or deaths was the sum of the predicted probabilities of readmission or death obtained from separate prediction models.

Readmission rates were corrected for ICU level (in which level 1 are the least and level 3 the most advanced ICUs), age, cardiovascular insufficiency, cirrhosis, hematological malignancy, cardio vascular accident, medical or surgical admission type, planned admission, mechanical ventilation in the first 24 hours of admission, chronic renal insufficiency, chronic dialysis, chronic obstructive pulmonary disease, respiratory insufficiency, neoplasm, immunological insufficiency, gastrointestinal bleeding, acute renal failure, confirmed infection, vasopressors, and logit transformed APACHE IV mortality probability[23]. Mortality rates were corrected for ICU level (in which level 1 are the least and level 3 the most advanced ICUs), age, cardiovascular insufficiency, cirrhosis, hematological malignancy, cardio vascular accident, medical or surgical admission type, planned admission, mechanical ventilation in the first 24 hours of

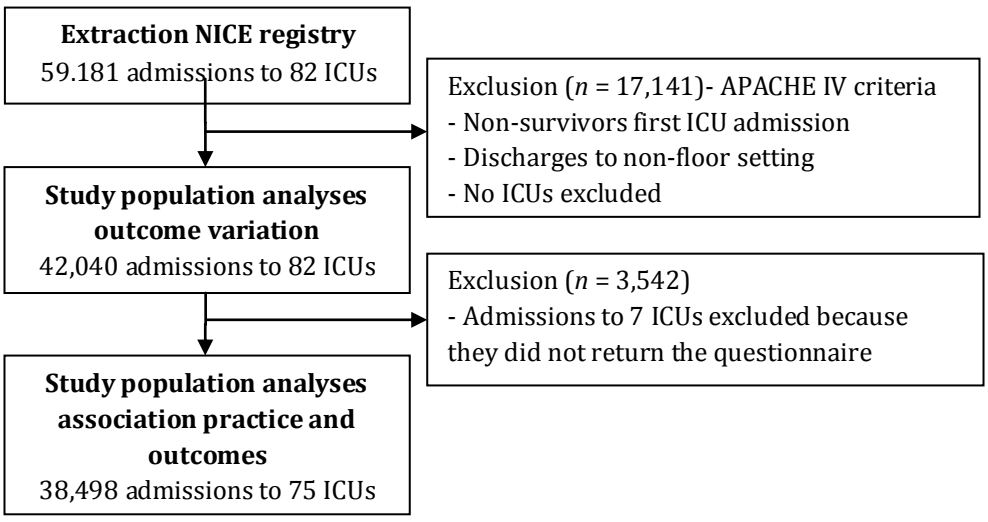
admission, chronic renal insufficiency, chronic dialysis, chronic obstructive pulmonary disease, respiratory insufficiency, neoplasm, immunological insufficiency, gastrointestinal bleeding, acute renal failure, confirmed infection, vasopressors, diabetes, cerebrovasculair accident, CPR, dysrhythmia, and logit transformed APACHE IV mortality probability[23]. We assessed the discrimination of the prediction models using the area under the receiver operating characteristic (ROC) curve[37] and the calibration using the Hosmer-Lemeshow goodness-of-fit statistic $\hat{C}$ with 10 groups[38] [38]. We presented the standardized rates in funnel plots with 95% and 99.8% control limits. We obtained the control limits under the assumption that the natural logarithms of the standardized rates follow a normal distribution[39]. ICUs outside the control limits can be interpreted as deviating significantly from the national rates.

We analysed the univariate association between ICU readmission and post-ICU in-hospital mortality and the eight ICU discharge practices using generalized estimation equations with a logit link function and robust variance estimators[40], while correcting for patient factors. We applied the Bonferroni correction to correct for multiple testing[41], and hence viewed the association between a ICU discharge practice and ICU readmission or post-ICU in-hospital mortality if p-value < 0.0056 (0.05 / 9).We performed the statistical analyses using IBM SPSS Statistics and R 2.13.0.

RESULTS

We extracted 59,181 first admissions to ICUs in 82 hospitals from the NICE registry (Figure 4.1). We excluded 17,141 (Appendix 4.1) and included 42,040 admissions (71.0%) when calculating standardised readmission and post-ICU mortality rates. The ICUs were in six (7.3%) university hospitals, 29 (35.4%) teaching hospitals, and 47 (57.3%) general hospitals. We present the patient characteristics in Table 2.

Figure 4.1. Flowchart of patients



NICE: national intensive care evaluation; ICU: intensive care unit; APACHE: acute physiology and chronic health evaluation.

Table 4.2. Patient characteristics

	(*n* = 42,040)
Median age in years (IQR)	65 (54 to 75)
Male (%)	23,832 (56.7)
Mechanical ventilation in the first 24 hours of admission (%)	14,810 (35.2)
Vasoactive medication (%)	11,183 (26.6)
Planned admission (%)	12,918 (30.7)
Readmissions (%)	3,463 (8.2)
Readmissions within 48 hours of ICU discharge (%)	1,216 (2.9)
Length of stay	
Median intensive care length of stay in days (IQR)	1.0 (0.80 to 2.9)
Median hospital length of stay in days (IQR)	11.0 (6.0 to 20.0)
Mortality	
Post-ICU in-hospital mortality rate (%)	2,811 (6.7)
APACHE IV standardized mortality rate	
Median APACHE III score (IQR)	49 (49 to 68)
Mean APACHE IV probability (SD)	0.15 (0.19)
APACHE IV standardized mortality rate (95% CI)	0.78 (0.77 to 0.80)
Admission type:	
Medical/non-surgical (%)	18,324 (43.6)
Emergency surgery (%)	7,139 (17.0)
Planned surgery (%)	16,577 (39.4)
Admission source:	
Operating theatre (%)	21,694 (51.6)
Emergency room (%)	8,262 (19.7)
Ward (%)	9,477 (22.5)
High or medium care (%)	159 (0.4)
Other hospital (%)	630 (1.5)
Other (%)	1,818 (4.3)
Comorbidity on admission:	
Confirmed infection (%)	6,300 (15.0)
Cardiopulmonary resuscitation (%)	1,177 (2.8)
Dysrhythmia (%)	3,136 (7.5)
Acute renal failure (%)	2,658 (6.3)
Cardiovascular accident (%)	1,513 (3.6)
Gastrointestinal bleeding (%)	977 (2.3)
Number of chronic comorbidities:	
None (%)	25,238 (60.0)
One (%)	11,538 (27.4)
Two (%)	4,042 (9.6)
Three (%)	1,029 (2.4)
More than three (%)	193 (0.6)
Patients discharged to:	
Ward (%)	39,493 (93.9)
Recovery or medium care (%)	1,239 (3.1)
Coronary care unit or other intensive care unit (%)	1,308 (3.0)

Rates of ICU readmissions and post-ICU in-hospital mortality

We found a crude ICU readmission rate of 2.9% (1,216/42,040). The standardized rates varied between 0.14 and 2.7 with, by definition, an overall target rate of 1.00. In Figure 4.2, we present a funnel plot of the standardized rates of ICU readmissions against the number of ICU admissions per ICU in 2011. In total, 66 (80%) ICUs fall within the 95% control limits, three (4%) above the upper, and 14 (17%) below the lower 95% control

limits. One (1%) hospital falls above the upper and two (2%) hospitals fall below the lower 99.8% control limits. The calibration ($\hat{C}$ = 18.1, p-value = 0.0205) and discrimination (area under the ROC curve = 0.63) of the standardization model for ICU readmissions were poor.

We found a crude hospital mortality rate of 6.7% (2,811/42,040). The standardized rates ranged between 0.1 and 2.1. In Figure 4.3, we present a funnel plot of these rates against the number of ICU admissions in 2011. Five hospitals (4.8%) have an adjusted post-ICU in-hospital mortality rate above the upper and nine (10.8%) below the lower 95% control limits. Four hospitals (5%) fall below the lower 99.8% control limits. Although the discrimination (area under the ROC curve = 0.82) of the standardization model for post-ICU in-hospital mortality was good, the calibration ($\hat{C}$ = 38.9, p-value < 0.0001) was poor.

Figure 4.2. Standardized rates of ICU readmission within 48 hours. Readmission rates were corrected for ICU level (in which level 1 are the least and level 3 the most advanced ICUs), age, cardiovascular insufficiency, cirrhosis, haematological malignancy, cardio vascular accident, medical or surgical admission type, planned admission, mechanical ventilation in the first 24 hours of admission, chronic renal insufficiency, chronic dialysis, chronic obstructive pulmonary disease, respiratory insufficiency, neoplasm, immunological insufficiency, gastrointestinal bleeding, acute renal failure, confirmed infection, vasopressors, and logit transformed APACHE IV mortality probability[23].

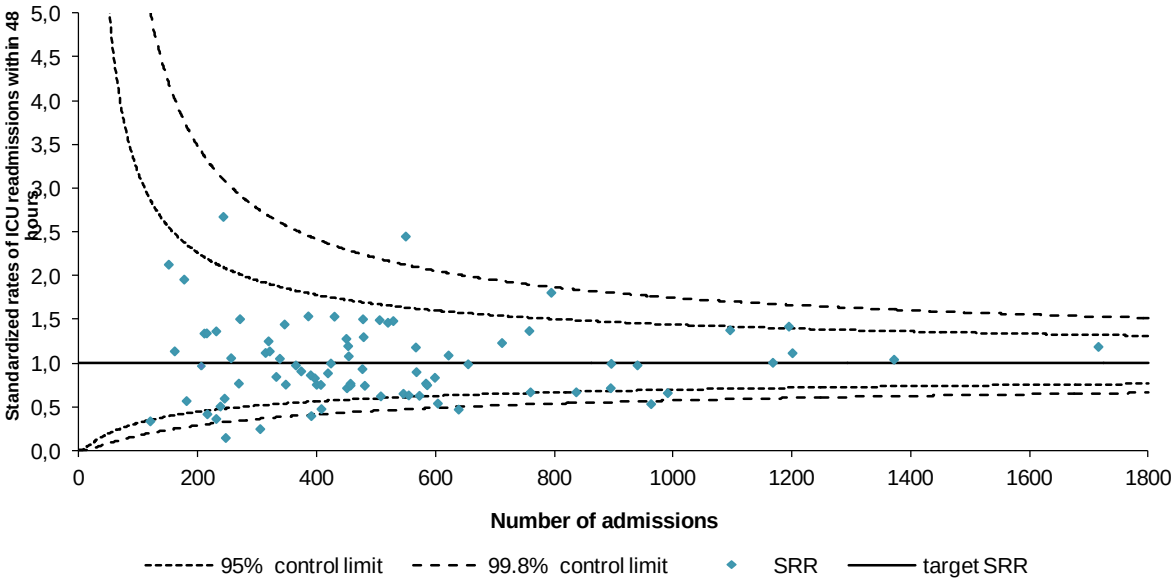
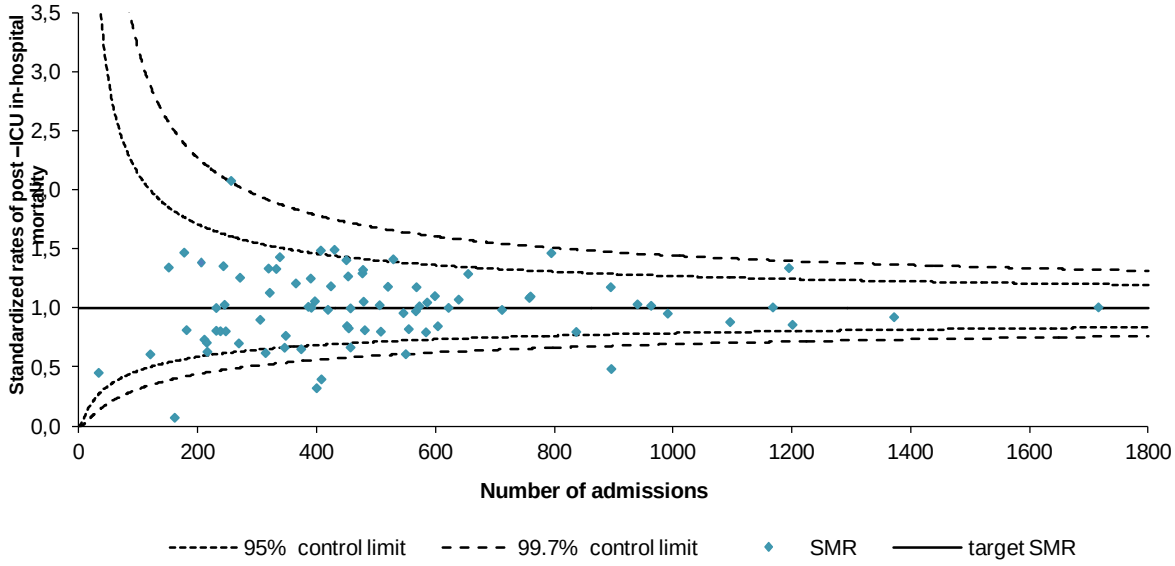


Figure 4.3. Standardized rates of post-ICU in-hospital mortality. Mortality rates were corrected for ICU level (in which level 1 are the least and level 3 the most advanced ICUs), age, cardiovascular insufficiency, cirrhosis, haematological malignancy, cardio vascular accident, medical or surgical admission type, planned admission, mechanical ventilation in the first 24 hours of admission, chronic renal insufficiency, chronic dialysis, chronic obstructive pulmonary disease, respiratory insufficiency, neoplasm, immunological insufficiency, gastrointestinal bleeding, acute renal failure, confirmed infection, vasopressors, diabetes, cerebrovasculair accident, CPR, dysrhythmia, and logit transformed APACHE IV mortality probability[23].



ICU discharge practices, ICU readmission and post-ICU in-hospital mortality

We had data from the NICE registry and a completed questionnaire for 75 ICUs (Appendix 4.4). To study the association between ICU discharge practices and ICU readmissions and post-ICU mortality, we excluded 3,542 admissions to the non-participating ICUs. Hence, we used data on 38,498 admissions (65.1%) to 75 ICUs in the analyses on associations between ICU discharge practices and ICU readmission and post-ICU in-hospital mortality (Figure 4.1). These ICUs were in six university hospitals (8.0%), 28 tertiary medical teaching hospitals (37.3%), and 41 general hospitals (54.7%). We present the results from the questionnaire in detail in Appendix 4.4.

Table 4.3 shows the percentages of ICUs, which had implemented each of the discharge practices, and the odds ratios of the association between the implementation of each discharge practice and ICU readmission and post-ICU in-hospital mortality. Following the Bonferroni correction, none of the ICU discharge practices nor the total number of ICU discharge practices implemented by each ICU were associated with the standardized rates of readmission or mortality.

Table 4.3. Rates of individual practices and odds ratios of association with patient outcomes

Individual practice rates in isolation					
Practices	*n* (%)	Case-mix adjusted[a] readmission rate OR (95% CI)	p-value	Case-mix adjusted[a] in-hospital mortality rate OR (95% CI)	p-value
Discharge criteria	53 (70.7)	0.95 (0.75-1.21)	0.6775	1.02 (0.83-1.24)	0.8541
Bed manager	71 (94.7)	1.08 (0.80-1.46)	0.6164	0.93 (0.52-1.68)	0.8128
Early discharge planning	40 (53.3)	1.04 (0.84-1.28)	0.7011	1.03 (0.89-1.20)	0.6667
Medication reconciliation	39 (52.0)	0.95 (0.78-1.17)	0.6587	1.00 (0.86-1.16)	0.9722
Communication at handover	49 (65.3)	0.90 (0.73-1.11)	0.9912	1.08 (0.92-1.28)	0.9442
Step-down facilities	21 (28.0)	1.21 (0.98-1.50)	0.0823	1.16 (1.01-1.34)	0.0423
Monitoring of post-ICU patients	49 (65.3)	1.02 (0.81-1.27)	0.8822	0.91 (0.78-1.07)	0.2654
Consulting ICU nurse	70 (93.3)	0.87 (0.64-1.19)	0.3948	0.90 (0.67-1.23)	0.5120
Combined practices score (median (IQR))	6 (5-7)	1.00 (0.93-1.10)	0.994	1.02 (0.95-1.08)	0.59548
Number of practices incorporated					
1	1 (1.3)				
2	3 (4.0)				
3	7 (9.3)				
4	10 (13.3)				
5	22 (29.3)				
6	18 (24.0)				
7	11 (14.7)				
8	3 (4.0)				

[a] Patient-related confounding factors for which is corrected are age, admission type (medical or surgical), planned admission, mechanical ventilation in the first 24h, logit transformed APACHE IV mortality probability.

[b] Significant odds ratio after Bonferroni correction ($p > 0.00625$).

DISCUSSION

The objective of our study was to describe variation in ICU readmissions within 48 hours and post-ICU in-hospital mortality and to study the association of these patient outcomes with the implementation of ICU discharge practices. Using funnel plots, we found that 17% of the hospitals fell outside the 95% control limits and 3% outside the 99.8% control limits with respect to ICU readmission and 14% and 4% with respect to post-ICU in-hospital mortality. The substantial proportion of ICUs with standardized readmission or mortality rates falling outside the control limits, suggests that there is more variation between hospitals on these patient outcomes than would be expected and that there is room for quality improvement. The extent of this variation is consistent with that reported in studies on ICU length of stay and mortality[42,43]. To study and to possibly explain the found variation, we subsequently studied the implementation of ICU discharge practices and their association with the occurrence of IC readmissions and post-ICU in hospital mortality rate.

In this study, we also found that ICU discharge practices vary. We had hypothesized that such variation could indicate that the ICU discharge process could be optimized and, hence, potentially improve patient outcomes and reduce healthcare costs[44,45]. However, we were unable to demonstrate an association between ICU discharge practices and rates of ICU readmissions or post-ICU in-hospital mortality. In addition, implementing a higher number of ICU discharge practices was not associated with better patient outcomes. Results of previous studies reporting about the association between the use of patient safety and quality improvement practices, and patient safety outcomes are diffuse. Some studies showed that compliance to discharge practices was associated with lower hospital complications and mortality rates[46,47], while others showed no association[48].

An important strength of this study is our large dataset covering more than 90% of all Dutch ICUs. In addition, we included the APACHE IV mortality probability in our case-mix correction models. Currently, the APACHE IV is the best performing model for case-mix correction for in-hospital mortality following ICU admission in the Netherlands[23,27].

Our study has some limitations. We strived to minimize the effects of case-mix differences between ICUs by presenting case-mix adjusted standardized rates for quantifying variation in patient outcomes. However, our case-mix correction models have not been externally validated and, in our dataset, the calibration of the models for ICU readmission and post-ICU mortality and the discrimination of the model for ICU readmission were poor. This means that these models may not adequately correct for case-mix differences between hospitals, potentially resulting in more hospitals than expected falling outside the control limits[49]. In addition, the variation between the rates of ICU readmission and post-ICU in-hospital mortality may still result from chance[50], overdispersion[39,51], an incorrect method for determining the control limits[52], or registration problems within the hospitals.

The number of admissions included in our analyses for some ICUs was very low. Therefore, even when using funnel plots, there is a low probability of detecting that these ICUs are performing differently from national rates[53].

We found no significant association between ICU discharge practices and patient outcomes which may be due to several limitations of our study. First, the power to detect a reduction in post-ICU mortality and ICU readmission rate was limited because we measured each of the discharge practices at hospital level and, although the response rate to the questionnaire was 91.4%, the number of ICUs was limited. Furthermore, some practices were present in almost every ICU. Second, the use of discharge practices were measured using a self-reported questionnaire, which may be susceptible to bias. Overestimation of own practices and socially desirable answers could have influenced our findings. However, Scholle and colleagues found only minor overestimation in their study and concluded that self-assessment could be useful for quality improvement purposes[54]. Third, in our regression models we used patient data, such as severity of illness and the APACHE IV reasons for ICU admission, measured at the time of ICU admission. Ideally, data representing the patient's condition at the time of ICU discharge would be used. However, these data are not available in the NICE registry. Fourth, we had no data on whether patients were discharged from the ICU for palliative care on the ward. This could have led to an overestimation of the mortality rates.

Clinical handover has been identified as a key process in improving quality of care and patient safety and reducing adverse patient outcomes[55,56]. Quantification of variation is a tool for uncovering suboptimal quality of care and may identify potential for improvement[57-59]. We found both variation in patient outcomes and in discharge practices and reasoned that this indicates potential for improving patient outcomes and subsequently, reducing healthcare costs[44,45]. However, we were not able to identify a relation between ICU discharge practices and patient outcomes. Further research is necessary to find factors, which may influence these patient outcomes, in order to improve quality of care. For example organisational factors, such as staffing and experience and skills of (ICU) personnel. Unfortunately, we were not able to include them in our research due to the lack of data of these factors. Exploratory research into the differences between the hospitals falling above the upper and below the lower control limits in our funnel plots may give insight into factors influencing quality of care.

Causes of ICU readmissions and post-ICU in-hospital mortality are likely to vary between hospitals. Although interventions to reduce the rates of these events have been described in the literature, our study shows that none of them are associated with better outcomes in the Netherlands. Examining individual ICU readmissions or post-ICU in-hospital mortalities locally may provide ICUs insight into potential areas for improvement in their own ICU discharge process.

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APPENDICES

Appendix 4.1. Number of admissions excluded per exclusion criterion.

	n
Total excluded from regression analyses	17,141[a]
ICU non-survivors during first intensive care unit admission	6213
ICU survivors discharged to a non-floor location	6151
APACHE IV exclusion criteria	
Age less than 16 years	341
Length of stay less than 4 hours	2683
Length of stay greater than 365 days	5
Died before admission	69
Patients with substantial burns	75
Patients with transplants (except renal and hepatic)	123
Admission from another intensive care unit	2807
Missing admission type	1254
Missing hospital discharge type	270
Missing APACHE III score	69
Missing APACHE IV reason for admission	1104
Missing discharge location	234

[a] The individual numbers in this table do not sum to the total, because some admissions are excluded for multiple reasons.

Appendix 4.2. Questionnaire 'ICU discharge practice' translated from Dutch to English

Demographic question

Question 1.

What is your function title?

Head of ICU / medical manager

Intensivist

Fellow

Nurse

Other, namely …

Discharge policy

Question 2.

Is policy concerning the discharge of ICU patients written down?

There is policy, approved by the medical staff

There is policy, approved by the medical staff and approved by the hospital board

There is policy, approved by the medical staff, approved by the hospital board and periodically tested and reported to the medical staff and hospital board

Policy is being developed

There is no policy written down

Question 3.

Is the NVIC guideline 'criteria voor opname en ontslag van de intensive care-afdelingen in Nederland' translated to a protocol?

Yes

No

Being developed

Question 4. (only if Question 3. was answered with 'yes')

Is this protocol available on the ICU? (multiple answers are possible)

Yes, on paper

Yes, electronically

Yes, with decision support

No

Question 5.

Are there set discharge criteria?

Yes

No

Being developed

Question 6.

Who takes the decision to discharge a patient from the ICU? (multiple answers possible)

Intensivist

Fellow

Resident

Nurse

Other, namely …

Question 7.

Is the responsibility for the discharge decision written down?
Yes
No

Question 8.[a]
On which items is a discharge decision or the postponement of discharge based? (multiple answers possible)

Set discharge criteria	in … % of the patients
Knowledge / view / experience of care professional	in … % of the patients
Logistic reasons (i.e., strain on ICU or ward beds)	in … % of the patients
Arguments based on nursing (i.e., nursing load)	in … % of the patients
Other, namely …	in … % of the patients

Preparation for discharge
Question 9.[a]
Is there a person who keeps track of the number of available beds on the ICU as well as on the step-down facilities?
Yes, an intensivist
Yes, a fellow / resident
Yes, a nurse
No

Question 10.[a]
Can you give an estimation of the percentage of patients with a ICU length of stay of more than 24 hours, which received 'early discharge planning'?
…%
(Definition early discharge planning: the preparation for patient discharge, such as coordination with the receiving ward about discharge time, starts at least 24 hours before actual transport of the patient.)

Handover
Question 11.
Is the medical and nursing handover separated?
Yes
No

Question 12.[a]
At ICU discharge: (multiple answers possible)
a written or electronic nursing discharge form goes along with the patient
verbal handover between nurses takes place
a letter with medical data, medication and treatment advice is send to the receiving ward directly
verbal handover between physicians takes place
Other, namely …

Question 13.
A structured handover consists of: (multiple answers possible)
a summary of the ICU admission, including diagnosis and treatment
monitoring plan and planning of medical tests
treatment plan, including medication, treatments, diets, infection status and treatment limitations
list of medications, including stopped medications and (changes in) medications used at home
allergy information
information about revalidation needs (i.e., physiotherapy, speech therapy)

specific communication and language needs
Other, namely …

Handover of medication information

Question 14.[a]

Can you give an estimation of the percentage of patients which received 'medication reconciliation'?
…%
(Definition medication reconciliation: creating a recent overview of current medications, (temporarily stopped) home medications and information about possible allergies. Home medication and allergies are verified with the patient or his or her relatives.)

After care

Question 15.[a]

Is general ward staff able to ask 24/7 for help or advice from a consulting ICU nurse about post-ICU patients?
Yes
No

Question 16.

Is help by the ICU arranged in certain nursing activities?
Yes, on a regular basis
Yes, incidentally
No

Question 17.[a]

Are post-ICU patients monitored on the wards? (multiple answers possible)

Yes, by a (consulting) ICU nurse	in … % of the patients
Yes, by an intensivist	in … % of the patients
Other, namely …	in … % of the patients
Are not visited	

Question 18.

Does your hospital have a medical emergency team (MET)?
Yes
No
Being developed

Concluding questions

Question 19.

Does your hospital use other practices than mentioned in this questionnaire to organize patient discharge from ICU to general ward?
(open question)

Question 20.

Are there any barriers at patient discharge from ICU to general ward, and if yes, can you describe them?
(open question)

Question 21.

Is there anything you like mention what was not yet mentioned in the questionnaire?
(open question)

Question 22.
Do you consent to linking the data from this questionnaire with data from the NICE registry? The linking will be done by staff of NICE and the results will be reported anonymized and aggregated.
Yes
No

[a] Questions used to analyze the association between ICU discharge practices and ICU readmission and post-ICU in-hospital mortality. Variables related to the use of a set discharge policy and the use of the Dutch guideline were excluded from further analysis because they did not comprise of practices which in themselves may improve quality. Policy and guidelines are used as methods to implement practices which aim to improve the quality of the discharge process. The variables related to the medical emergency team were also excluded from further analysis. After deliberation with experts of intensive care it was decided that this practice was unlikely to have an impact on the ICU discharge process, and thus was outside the scope of the study.

Appendix 4.3. Dichotomising Questionnaire variables

Question	**Answers**	**Dichotomous variables**
On which items is a discharge decision or the postponement of discharge based?	Set discharge criteria yes/no Knowledge/view/experience care professional yes/no Logistic reasons yes/no Arguments based on nursing yes/no Other yes/no	Set discharge criteria yes (1) Set discharge criteria no (0)
Is there a person who keeps track of the number of available beds on the ICU as well as on the step-down units?	Yes, an intensivist Yes, a fellow/resident Yes, a nurse No	Yes, an intensivist (1) Yes, a fellow/resident (1) Yes, a nurse (1) No (0)
Can you give an estimation of the percentage of patients with a ICU length of stay of more than 24 hours, which received 'early discharge planning'?	[1-100]%	Median = 20 → 0-19% (0) 20-100% (1)
At ICU discharge:	A written or electronic nursing discharge form goes along with the patient yes/no Verbal handover between nurses takes place yes/no A letter with medical data, medication and treatment advice is send to the receiving ward directly yes/no Verbal handover between physicians takes place yes/no Other yes/no	If 'a written or electronic nursing discharge form goes along with the patient' is yes AND 'verbal handover between nurses takes place' is yes AND 'a letter with medical data, medication and treatment advice is send to the receiving ward directly' is yes AND 'verbal handover between physicians takes place' is yes (1) All other options (0)
Can you give an estimation of the percentage of patients which received 'medication reconciliation'?	[1-100]%	Median = 95 → 0-94% (0) 95-100% (1)
Is general ward staff able to ask 24/7 for help or advice from a consulting ICU nurse about post-ICU patients?	Yes No	Yes (1) No (0)
Are post-ICU patients monitored on the wards?	Yes, by a (consulting) ICU nurse Yes, by an intensivist Other No	Yes, by a (consulting) ICU nurse (1) Yes, by an intensivist (1) Other (1) No (0)

Appendix 4.4. Results questionnaire[a]

No.	**Question**	***n* (%)**
1.	**Function title**	
	Head of ICU / medical manager	27 (36.0)
	Intensivist	42 (56.0)
	Fellow	0 (0.0)
	Nurse	3 (4.0)
	Other	3 (4.0)
2.	**Discharge policy**	
	Yes, approved by medical staff	32 (42.7)
	Yes, approved by medical staff and approved by hospital board	29 (38.7)
	Yes, approved by medical staff, approved by hospital board, and periodically tested and reported to medical staff and hospital board	8 (10.7)
	Being developed	1 (1.3)
	No	5 (6.7)
3.	**Protocol NVIC guideline**	
	Yes	68 (90.7)
	No	4 (5.3)
	Being developed	3 (4.0)
4.	**Protocol available (multiple answers possible)**	(n = 68)
	Yes, on paper	21 (28.0)
	Yes, electronically	63 (84.0)
	Yes, with decision support	0 (0.0)
	No	0 (0.0)
5.	**Set discharge criteria**	(n = 74)
	Yes	66 (88.0)
	No	6 (8.0)
	Being developed	2 (2.7)
6.	**Discharge decision (multiple answers possible)**	
	Intensivist	75 (100.0)
	Fellow	4 (5.3)
	Resident	2 (2.7)
	Nurse	3 (4.0)
	Other	2 (2.7)
7.	**Responsibility discharge decision**	
	Yes	69 (92.0)
	No	6 (8.0)
8.	**a. Basis on which discharge decision is taken (multiple answers possible)**	
	Discharge criteria	53 (70.7)
	Knowledge / insight / experience	70 (93.3)
	Logistic reasons	56 (74.7)
	Arguments based on nursing	63 (84.0)
	Other	14 (18.7)
	b. Percentage of patients discharged on specific basis [*n* (mean percentage/median percentage)]	
	Discharge criteria	48 (66.2/80)
	Knowledge / insight / experience	64 (63.5/80)
	Logistic reasons	51 (8.2/5)
	Arguments based on nursing	55 (10.3/5)
	Other	11 (13.2/1)
9.	**Bed manager**	
	Yes, intensivist	52 (69.3)
	Yes, fellow / resident	4 (5.3)
	Yes, nurse	38 (50.7)
	No	4 (5.3)
10.	**Percentage of patients with early discharge**	

	planning [*n* (mean percentage/median percentage)]	72 (27.7/20)
11.	**Separated medical and nursing handover**	
	Yes	72 (96.0)
	No	3 (4.0)
12.	**Methods of communication (multiple answers possible)**	74 (98.7)
	Written or electronic nursing discharge form	73 (97.3)
	Verbal nursing handover	62 (82.7)
	Medical discharge summary	54 (72.0)
	Verbal medical handover	8 (10.7)
	Other	
13.	**Content structured handover (multiple answers possible)**	74 (98.7)
	Summary ICU admission	39 (52.0)
	Monitoring plan en planning of tests	70 (93.3)
	Treatment plan	72 (96.0)
	List of medications	66 (88.0)
	Allergy information	58 (77.3)
	Revalidation information	31 (41.3)
	Communication needs	12 (16.0)
	Other	
14.	**Percentage of patients with medication reconciliation [*n* (mean percentage/median percentage)]**	73 (75.0/95)
15.	**Consulting ICU nurse**	
	Yes	70 (93.3)
	No	5 (6.7)
16.	**Help with nursing activities**	
	Yes, regularly	53 (70.7)
	Yes, incidentally	22 (29.3)
	No	0 (0.0)
17.	**a. Monitoring post-ICU patients**	
	Yes, Consulting ICU nurse	45 (60.0)
	Yes, intensivist	11 (14.7)
	Yes, other	15 (20.0)
	No	26 (34.7)
	b. Percentage of patients monitored by specific person [*n* (mean percentage/median percentage)]	
	Yes, Consulting ICU nurse	40 (49.9/50)
	Yes, intensivist	10 (16.0/10)
	Yes, other	12 (66.7/80)
18.	**Medical emergency team**	
	Yes	70 (93.3)
	No	0 (0.0)
	Being developed	5 (6.7)

Chapter 5

Ethical problems in intensive care unit admission and discharge decisions: a qualitative study among physicians and nurses in the Netherlands

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BMC Medical Ethics 2015;16:9.

ABSTRACT

Background: There have been few empirical studies into what non-medical factors influence physicians and nurses when deciding about admission and discharge of ICU patients. Information about the attitudes of healthcare professionals about this process can be used to improve decision-making about resource allocation in intensive care. To provide insight into ethical problems that influence the ICU admission and discharge process, we aimed to identify and explore ethical dilemmas healthcare professionals are faced with.

Methods: This was an explorative, descriptive study using qualitative methods (individual and focus group interviews). We conducted 19 individual interviews and 4 focus group interviews with nurses and physicians working in the ICU or the general ward of 10 Dutch hospitals.

Results: The ethical problems in the context of ICU admission and discharge can be divided into problems concerning full bed occupancy and problems related to treatment decisions.
The gap between the high level of care the ICU can provide and the lower care level in the general ward sometimes leads to mutual misunderstandings. Our results indicate that when professionals of different wards feel there is a collective responsibility and effort to solve a problem, this helps to prevent or alleviate moral distress.
ICU patients' wishes are often unknown, causing healthcare professionals to err on the side of more treatment. Additionally, the highly technological nature of intensive care appears to encourage over-treatment.

Conclusions: It is important for ICUs and general wards to communicate and cooperate well, since there is a mutual dependency for optimal patient flow between the different departments. Interventions that improve the understanding and cooperation between these wards may help mitigate ethical problems.
The nature of the ICU environment makes it important for healthcare professionals to be aware of the risk of over-treatment, reflect on why they do what they do, and be mindful of a possible negative impact of over-treatment on their patients. Early discussion of a patient's wishes with regard to treatment options is important in preventing over-treatment.

BACKGROUND

The intensive care unit (ICU) is a high pressure environment, where expensive care is delivered by highly qualified personnel to patients suffering from potentially life-threatening diseases. Bed availability is limited, making high patient throughput important. This throughput is dependent on the admission of new patients, and

discharge to general wards of those whose ICU care requirement is supposed to have ended. Financial pressure from society as well as higher management is increasing. Critical care services represent an increasing proportion of total hospital costs, up to 8% in 1980 to 20% in 2006 in the United States[1]. In the Netherlands, the costs of ICU departments have been estimated to represent approximately 20% of the total hospital budget[2]. The limited number of ICU beds as well as the pressure of ICU care on the total hospital budget, necessitates optimal use of ICU beds and patient flow from emergency room, operating theatre and general ward to ICU and vice versa.

The ICU is an ethically charged environment: life and death decisions are made daily, in acute, highly emotional situations that often involve legally incompetent patients and their family. Decisions to admit or discharge a patient are often not merely medical decisions. Non-medical aspects, such as pressure from managers or patients, may play a role in the decision-making process[3-5]. Therefore, the ideal of decision-making based on objective medical criteria can be very difficult to achieve.

Particularly when medical criteria alone are insufficient in deciding what is the right thing to do, healthcare professionals can be faced with an ethical dilemma; a conflict of values can occur which makes every possible decision less than optimal on moral grounds. For instance, deciding whether to discharge a patient not quite ready for the general ward to create a bed space for a gravely ill patient in need of intensive care[6-8].

There have been few empirical studies into what non-medical factors influence physicians and nurses when deciding about admission and discharge of ICU patients[3-5,9]. These studies were predominantly based on quantitative questionnaire research and focussed solely on the ICU perspective. They found considerable variation between countries and individual practitioners with respect to the factors taken into account. In addition, they showed that pressure from supervisors or managers, referring physicians, family or patients may influence decisions to admit or discharge ICU patients[3-5]. These factors may cause the healthcare professional involved to experience moral distress: stress that "occurs when one knows the right thing to do, but institutional or other constraints make it difficult to pursue the desired course of action"[10-12].

So far, little is known about the views of healthcare professionals involved in the admission and discharge process. There is a dearth of research that includes all relevant perspectives – physicians and nurses from both the ICU and the general ward – and uses qualitative methods to explore these views in depth. Information about the attitudes of healthcare professionals about this process can be used to improve decision-making about resource allocation in intensive care. To provide insight into ethical problems that influence the ICU admission and discharge process, we aim to identify and explore ethical dilemmas healthcare professionals are faced with.

METHODS

Design and setting

This is a descriptive, explorative study in which qualitative methods (individual and focus group interviews) are used to identify and explore ethical dilemmas. Semi-structured face to face interviews are useful to explore sensitive topics in-depth[13]. In the subsequent focus groups, the group dynamic and interaction among participants helps to further explore and clarify participants' views[13].

We included Dutch hospital physicians and nurses, working either in the ICU department, or a general ward regularly admitting patients from the ICU.

Individual interviews

Before the start of the study, contact was established by telephone with ICU physicians in six hospitals: two general, two teaching, and two academic hospitals. Through these six hospital contacts, physicians and nurses were recruited for face to face interviews. Inclusion criterion was involvement in (post-) ICU patient care; working as a physician or nurse in either the ICU, or in a general ward regularly admitting post-ICU patients. The prospective participants were informed by email about the objective of the study, and were invited to participate. The interview took place at the participants' place of work. The amount of interviews depended on the point of saturation, in other words when no new information could be identified in the interviews[13]. An interview guide, see "Example of interview guide".

All interviews were held between April and December of 2012. They were conducted by a trained and experienced interviewer (AO), in the presence of on other researcher (NvS). Audio of the interviews was recorded and subsequently transcribed verbatim.

Example of the interview guide

Interview guide for ICU nurse interviews.

- What ethical dilemmas surrounding ICU admission and discharge do you face in your daily work?
- Do you ever disagree with the decision to admit a patient to the ICU? Please give an example.
- Do you ever disagree with the decision to discharge an ICU patient? Please give an example.
- Could you give an example of a situation in which problems arose regarding the admission of an ICU patient?
- Could you give an example of a situation in which problems arose regarding the discharge of an ICU patient?
- What happens when all ICU beds are occupied and the ICU receives a request for an ICU bed?
- Could you give an example of this happening?
- How was this acted upon?

The interview guides for the other types of stakeholder interviews are available on request.

Focus group interviews

To explore the themes and dilemmas identified in the individual interviews more in depth, we conducted four focus group interviews with: (1) ICU physicians, (2) ICU nurses, (3) general ward physicians, and (4) general ward nurses. A focus group interview guide was designed around two or three fictional cases, all of which were checked for medico-technical accuracy by three physicians (for example, see "Example of a fictional case used in the focus groups"). These cases were compilations of dilemmas described by interview participants and/or case studies found in the literature[14-17].

Recruitment for the focus group interviews took place through snowball sampling: initially, the ICUs and general wards of the six initial hospitals were contracted and through these contacts, physicians and nurses of relevant wards in other hospitals were contracted and invited. The participants were sent the case descriptions by email and were asked to read them in advance. The focus groups interviews were led by a moderator (WD for focus groups 1 and 2, AO for focus groups 3 and 4), respectively three (NvS, MZ, AO) and two (NvS, MZ) other researchers were present for the discussions, both to observe as well as to assist the moderator. Each focus group interview commenced by explaining the goal of the meeting, introducing the researchers, and introducing the focus group participants.

The focus group meetings took place in January of 2013. Audio of the interview was recorded, and a note taker was present at the meetings. The interviews were transcribed verbatim. The transcript of the focus group interviews was sent to the participants for corrections and additional comments.

Example of a fictional case used in the focus groups
(for general ward physicians and general ward nurses)
Mr. Anouh, 68 years old, has been on haemodialysis for a number of years due to renal failure. He was admitted to the Nephrology Department with a staphylococcal sepsis, where they are experiencing problems in keeping his blood pressure up. He has been given lots of fluids, but his blood pressure remains low. Then, he develops a watershed infarction (stroke). Sometime that afternoon, the ward doctor calls the ICU for a consult. The ICU physician on duty indicates that he wants to admit Mr. Anouh, but does not have a bed available at the moment – "we don't have another solution right now, just keep filling him," is his message. It turns 5pm, 6pm, 7pm, and Mr. Anouh is still at the nephrology ward, where his condition keeps deteriorating. In the meantime his family has arrived. They are very upset about the state of affairs, since his nurse had told them hours ago that he would be admitted to the ICU. Mr. Anouh's nurse feels very powerless too.

Ethical approval

Ethical approval was sought from the Research Ethics Committee of the Radboud University Nijmegen Medical Centre (registration number: 2011/483); the committee judged that ethical approval was not required under Dutch National Law. All participants received written information about the project and its aims, and were

subsequently invited to participate. We stressed that participation in this study was voluntary and withdrawal from the study was possible at any time. The anonymity of participants and institutions was maintained in the interview transcripts.

Analysis

The interview and focus group transcripts were coded using ATLAS.ti 6.2 (developer: ATLAS.ti Scientific Software Development (GmbH). The analysis was conducted using a grounded theory approach, in which the codes and codebook emerge from the data (as opposed to previously formulated hypotheses which are "tested" against qualitative data)[18,19]. The first five individual interviews were coded by AO, NvS and MZ, after which any discrepancies were discussed until consensus was reached. A double analysis (AO and MZ) and subsequent discussion was also performed for the first focus group interview transcript. All other transcripts were coded by one researcher (AO). We used the COREQ guideline for qualitative research for both design and analysis[20]. Our study adhered to BioMed Central's modified RATS guidelines.

RESULTS

Study population

We conducted 19 semi-structured individual interviews with ICU physicians, ICU nurses, general ward physicians, and general wards nurses (for participant characteristics, see Table 5.1). The interviews took between 30 and 120 minutes. All invited agreed to participate, except for one ICU physician who declined for scheduling reasons.

We conducted four focus groups interviews with ICU physicians, ICU nurses, general ward physicians, and general ward nurses (Table 5.1). The focus group interviews took between 60 and 90 minutes. Seventeen ICU physicians were invited, 5 were present at the focus group interview. Thirty-six general ward physicians were invited, 5 of whom participated in the interview. Twenty-five ICU nurses were invited, 7 of whom took part in the interview. Twenty-five general ward nurses were invited, 8 of whom participated in the focus group.

Ethical problems

The individual and focus group interviews showed that in the context of the ICU admission and discharge process, ethical problems arise at different points in time: (A) when (deciding about) admitting a patient to the ICU from the emergency room, operating theatre or a general ward, (B) during a patient's stay in the ICU, (C) when (deciding about) discharging a patient from the ICU. We will now go through these phases, and elaborate on the different ethical problems healthcare professionals encounter in their work.

Table 5.1. Characteristics of interview and focus group participants

	Interviews (n = 19)	Focus groups (n = 25)
Job title		
ICU physician (%)	7 (37)	5 (20)
ICU nurse (%)	6 (32)	7 (28)
Ward physician (%)	3 (16)	5 (20)
Ward nurse (%)	3 (16)	8 (32)
Male (%)	11 (58)	8 (32)
Hospital type		
General (%)	6 (32)	5 (20)
Teaching (%)	7 (37)	10 (40)
Academic (%)	6 (32)	10 (40)
Years of experience in current speciality		
< 5 years (%)	7 (37)	5 (20)
5 – 10 years (%)	4 (21)	7 (28)
> 10 years (%)	8 (42)	13 (52)

Phase A: Admission to the ICU

For quotations related to phase A, see Table 5.2.

Delayed or refused admission to the ICU

As our participants indicated, ICU bed pressure causes problems for general wards (including the emergency room) with a patient in need of ICU care: ICU admission is delayed or sometimes even refused, and elective surgeries are cancelled because no post-surgery ICU bed is available. In addition to possible negative consequences to a patient's health, this leads to frustration for both the patient and his family, as well as for nurses and physicians in the general ward in question. At the heart of this moral distress is the desire to provide the best care possible, but being unable to do so, often for reasons beyond the caregiver's control. The aforementioned fictional case of Mr. Anouh (see "Example of a fictional case used in the focus groups") is an example of such a situation. As the interviews made clear, these situations are especially difficult for the general ward nurses. As several general ward nurses described, the combination of being in close proximity to the patient, but not being the one making the decisions can lead to a feeling of tremendous powerlessness. For the general ward physicians interviewed, too, these situations can be difficult, especially when they have the impression that they carry sole responsibility for the well-being of this patient. The degree to which they feel the ICU physician takes his or her responsibility to try and solve the problem, greatly influences the distress general ward physicians experience, as they indicated in the interviews.

Participants highlighted that because of the mutual dependency of the ICU and the general ward, collaboration between the healthcare professionals in both wards is important to ensure optimal patient flow and care. The interviews made clear that general ward personnel perceive the ICU and its personnel as different from the "regular" wards. This is due in part to the physical separation of the ICU from the rest of the hospital (separate wing, closed doors, need to ring the bell before entering etc.), and partly to the perceived psychological distance between the different wards. Terms such

as “arrogant”, “ivory tower”, and “island” were used often, although participants mentioned that the situation has improved over time, and the behaviour varies between persons. In particular general ward nurses described they sometimes perceived a barrier when having to call the ICU about a patient, or asking ICU personnel for help with certain medical interventions.

Need to transfer a patient to a different hospital (according to guideline)
All participants recognised the situation of full ICU bed occupancy, but the frequency with which it happens and the degree to which they experience it as a problem varies. In some cases, it means that the patient in need of ICU care – either from one of the general wards or brought in through the emergency room – is stabilized and subsequently transported to be cared for in a different ICU in another hospital, meanwhile being at risk through delay of (intensive) care and the transport itself. Sometimes, a stable patient in the ICU is transferred to an ICU elsewhere, often because the new patient is deemed too unstable to withstand care delay and transport. In the Netherlands, a guideline pertaining to this situation (“Admission request in case of full ICU bed occupancy” of the Dutch Society for Intensive Care) prescribes that in principle, no patients already admitted to the ICU should be transferred to make room for a new admission, since there is a treatment contract between admitted patients and their physician/the hospital, that cannot be terminated unilaterally[21]. The vast majority of the ICU physicians admitted they did not use the guideline in daily practice. The importance of an existing treatment relationship in deciding who to transfer was disputed by several physicians. They indicated that they preferred (and still used) a risk-based approach; the patient with the lowest transport risk would be the one to go.

Table 5.2. Ethical problems related to ICU admission

Problem	Participant	Representative quotes
Delayed/refused admission	General ward nurse	*"Look, you see a patient deteriorate and be sad and in fear and pain, and at a certain point you can't really do much more than what the doctor says you should do and what you know you should so at that time. Of course, initially that's the most important thing, but at a certain point you can't do more than execute the doctor's orders and keep the patient as stable as possible, but the capabilities of a general ward are pretty limited, you know? And then it's just waiting for what a doctor decides and sometimes that's ... that takes a very long time."*
	General ward physician	*"If we* [the general ward physician and the consulting ICU physician, AO] *agree that the patient in question is actually an ICU patient, then I think it should be a shared responsibility, If our own ICU doesn't have a bed, then another bed in a difference place needs to be found. And then it's not like 'I just don't have a bed'."*
Need to transfer a patient to a different hospital (according to guideline)	ICU physician	*"In the beginning, I had a lot of problems with it* [the guideline on an admission request in case of full bed occupancy, AO], *the way it was drawn up. It went completely against my own way of thinking. I took the risks as a starting point. Which patient can you help the most here, who will suffer most from not being admitted at that moment."*
	ICU physician	*"There was an unspoken agreement among ICU physicians that the patient with the lowest risk went. Always. The lowest transport risk is the one to go. The guideline interfered with that concept."*
	ICU physician	*"This is an intrinsic error in the guideline. I think we all feel very strongly that you should act on the basis of clinical insight and weighing of risks."*
Difference of opinion about the start of ICU treatment	General ward physician	*"I notice that the longer I've worked here, I kind of got..for me it's kind of a slippery slope, because they're not really well-defined terms you know, what futility is. I think futility is a very subjective concept and what you consider futile can be very meaningful for me, very valuable, just, that's the way it is for such a patient too. In the beginning I was more straightforward, and now my thinking is much more nuanced and I can more easily go along with family in those cases than a couple of years ago."*
	General ward physician	*"To a large extent it is our interpretation of such an existence or of that quality of life, of which we think - well, is that worth the effort? Even though at such an acute time, that could be completely different for the family or the patient. I have a couple of patients that, well, literally are unable to do anything but lie in bed all day without consciousness but the family still considers it to be very meaningful."*

	ICU physician	*“I think we sometimes admit people we shouldn't admit, and I think that sometimes we can say in advance that we shouldn't have let this patient go to the ICU, but we're too afraid that we judge things too negatively and we do it anyway, but with the result that we treat the patient for too long.”*
	ICU physician	*"I've come to an age where I've become careful. I've been wrong too many times. You can only stop once.”*
Decision to admit/treat was based on inaccurate/incomplete information	ICU physician	*"The worst, I think, is when a patient is admitted who was resuscitated in the general ward and the family comes in a short time later and says - 'daddy wouldn't have wanted this'. Then real lines were crossed, invasive medical acts were performed based on misinformation. Well, I think that's a shame.”*
	ICU physician	*"Look, when it's very difficult to keep a patient stable, it's simple. Then you just pull out the tube, give a little morphine: done, you know? But if the patient becomes nice and stable, well, then you have a very difficult problem of course.”*

Difference of opinion about the start of ICU treatment

Questions surrounding the futility of treatment were one of the most frequently mentioned sources of ethical dilemmas, especially among ICU physician and nurses. Although there is often consensus surrounding the decision to admit a patient to the ICU and start intensive treatment, in some cases those involved disagree on the right thing to do for the patient in question – be it ICU personnel, general ward personnel, family or the patient him- or herself.

According to our participants, the expected quality of life after hospital discharge appeared to be the main deciding factor in dilemmas about the possible futility of ICU treatment. However, many participants recognized the subjectivity of these quality of life predictions. When in doubt, therefore, physicians tended to err on the side of treatment. Participants indicated that sometimes, a patient is treated longer or more aggressively than the patient would have wanted. In those cases a patient's wishes are often unknown to the treating physician, either because they have not been discussed, or because they were not adequately recorded in the patient's records. ICU physicians expressed frustration that they are regularly confronted with elderly patients in poor condition who spent a substantial amount of time in a general ward, without general physicians having discussed their treatment wishes with them.

Decisions to treat was based on inaccurate/incomplete information

As many respondents described, inherent to critical care medicine is the need to make decisions in acute situations: a critically ill patient is brought in to the emergency room, or a general ward is suddenly faced with a patient in cardiac arrest. This context sometimes leads to decisions based on inaccurate information, such as the decision to resuscitate someone who is later found to have a do-not-resuscitate order in place. These spur-of-the-moment decisions can then lead to complex dilemmas, especially when a patient remains in stable but serious condition after resuscitation, with the patient's family indicating the patient in question would not have wanted it that way.

Phase B: In the ICU

For quotations related to phase B, see Table 5.3.

Expansion of treatment indications

Several healthcare professionals interviewed, mainly from the ICU, perceived a shift in what conditions are treated; they witnessed and expansion of treatment indications for certain interventions. When introduced, a certain treatment was only applied in a very specific group of patients (for example, mechanical ventilation for patients with a moderate case of COPD), but over the years (especially when the treatment looked to be beneficial in many patients) the types and severity of illness its is used to treat has broadened. On the one hand, this development was considered a positive one – a sign of scientific and technical progress. Others, specifically ICU nurses, were critical of this development, indicating that it led to prolonged treatment that they did not consider beneficial to the patients in question.

Difference of opinion about the stopping of treatment
Similar to the differences of opinion surrounding the admission of a patient to the ICU, there can be a difference of opinion about whether to continue or withdraw life-sustaining treatment of a patient already in ICU, whether it be between family and hospital staff, between physicians and nurses, or between individual healthcare professionals. When our participants describe these situations, the difference in perspective between nurses and physicians become very apparent. Where physician have a "cure" perspective and have a decision-making role, nurses work form a "care" perspective and spend more time at a patient's bedside, in direct contact with the patient and their family. Without exception, our respondents indicated that generally, when there is a difference of opinion about the futility of continuing treatment it is the nursing staff that is in favour of withdrawing treatment while physicians want to continue.

Patient is stable after withdrawing life-sustaining treatment
As our participants described, when the decision is made to withdraw life-sustaining treatment in the ICU, the expectation is that the patient will die shortly. IN some cases however, the patient in question remains in stable condition, and although he/she is still expected to die in the near future, it is impossible to predict exactly when. Strictly speaking, such a patient is no longer in need of ICU care and is occupying a bed that other patients are in urgent need of. Here, we again noticed a clear difference between those in the decision-making role, ICU physicians, and those in the care role, ICU nurses. Where nurses are focused on the needs of the individual patient and their family, physicians are also responsible for optimizing the patient flow into and out of the unit.

Patient is stable as long as ICU care is given
Our participants indicated that with the increased technological possibilities, the ICU is able to sustain increasingly sicker patients for longer periods of time. This leads to cases of patients that are in stable condition in the ICU, sometimes even awake and able to communicate, as long as intensive treatment is provided. There is no chance of these patients ever being able to leave the ICU, but as long as life-sustaining treatment is not withdrawn, they will carry on living. Several participants described these situations as emotionally draining, especially when patients are able to communicate.

Phase C: Discharge from ICU
For quotations related to phase C, see Table 5.4.

Premature or suboptimal ICU discharge
From the interviews it becomes clear that the gap between the ICU and the general ward is often substantial, resulting in suboptimal care for post-ICU patients and mutual misunderstandings and irritation between ICU and general ward. In the view of general ward personnel, the ICU staff sometimes overestimates the technical skills of the ward

personnel, and the amount of time and attention the ward personnel is able to give each patient. In those cases, there is no absolute lack of beds in the general ward, but a relative lack of care capacity in relation to the existing care burden. However, when there is pressure on the beds in the ICU and someone is (almost) ready to be discharged, the ICU pressures the general wards into admitting a post-ICU patient.

Table 5.3. Ethical problems in the ICU

Problem	Participant	Representative quotes
Expansion of treatment indications	ICU physician	*"There are a number of cases we wouldn't have touched in the past. We wouldn't even have been asked to consult on them. Or when we would've been asked, then it would always be like: 'well, you're not going to start this, but can you just help us with the decision not to go to the ICU with this'. But now..you see it shift because we've seen patients come out of a situation like that, who we've then given a period of good time afterward."*
	ICU nurse	*"The very serious COPD patients..those weren't admitted about 10 years ago because they just thought - those aren't going to make it. And now we still know that the odds of them making it are slim, and they are going to need a rehabilitation course of a year to survive. Well, what did we achieve then?"*
Difference of opinion about the stopping of treatment	ICU physician	*On the difference between physicians and nurses:* *"Their contact with the patient is much more intense. They're at the bedside daily, experience the patient daily, how they are feeling, what mood they're in, those kinds of things. They suffer with them, they feel what the patient feels."*
	ICU nurse	*"As a nurse you see the patient more often, or you speak with the family more often. As a doctor you only see the patient when you come into the room and therefore, as a nurse, you have more feelings about..well..what you're doing, whether you agree with it. And I think as a nurse you more often feel like, well, maybe we should stop this. Because a doctor is very much like – you're there to make the patient better and, they don't see the patient for very long. In any case, I can't think of an example in which the doctor was like – 'well, let's stop this', and the nurse didn't agree with it."*
	ICU nurse	*"I remember a case of a pretty young guy, not yet fifty, who had had a motorcycle accident and had both legs amputated above the knee, as well as part of his arm. So he was lying in bed with one complete arm plus internal injuries and then you think, just let someone like that..because he'll get lots of complications. With that case we* [the ICU nurses; AO] *were like 'you shouldn't do this'. Eventually the ICU physician pushed through. To this day, once every year that guy comes by to thank everyone, that they kept on and treated him. Then I'm like - here I am with my big mouth."*
	ICU physician	On individual differences among ICU physicians: *"Among our staff, and I think that's the case everywhere, there is a difference between people who are quicker to stop treatment and people who'd rather never stop, and the grey zone in the middle. Those people with the scythe who want to abstain everyone at every turn, they're too fast. But the people who never want to stop because they think 'well, you can never be sure, I won't make*

		that decision, I don't dare to take on that responsibility', well, they go on too long with people that really should have passed away ages ago. And the truth lies somewhere in the middle, but that's why it's good to discuss a decision like that during a multidisciplinary meeting, so that all the different perspectives can give their response, and that is how it happens."
	ICU physician	On the reluctance of some physicians to abstain a patient from treatment: *"That is driving up healthcare costs, giving the family false hope, causing the nursing staff to become demotivated because they already know it's not going to work. But it takes guts and that's a problem. It takes guts to decide this, it takes guts to go and talk to the family and say it out loud, it takes guts to explain to your colleagues that you're not going to continue. Well, for me it's not that hard, but it is a difficult part of our profession, with which some of my colleagues clearly have more trouble."*
Patient is stable after withdrawing life-sustaining treatment	ICU physician	*"The patient was expected to die soon, but that didn't happen. Then you have to, then you transfer a patient to the ward, who'll only go there to die. That is..that was difficult for a while. But we do need that bed."*
	ICU nurse	*"We had a case in which the doctor said - 'okay, we're going to transfer him to the general ward, and then a new admission will come in his place'. No way, we're not going to do that. Then they'll just have to transfer out someone else. But those are..we really fought about that one, you know."*
Patient is stable as long as ICU care is given	ICU nurse	*"It's specifically the group that kind of slips through all the cracks, a patient who starts to breathe on his own, those are the difficult categories. No one will be able to make a decision about that. Like, he breathes on his own, let's wait and see. And ultimately it becomes days, weeks."*
	ICU physician	*"We create this type of patient because we can do so much [...] It's a good thing to have these patients now and again. It means the aggressiveness of your treatment is high. It means that you don't deprive a great number of other patients. But this is the risk of being very aggressive, or going very far in your treatment."*

Table 5.4. Ethical problems related to ICU discharge

Problem	Participant	Representative quotes
Premature/ Suboptimal discharge	General ward nurse	*"We as a general ward think beforehand - 'we cannot give that care' and the ICU thinks - 'that should absolutely be possible'. I do get it from an ICU point of view, but you just don't realize what it sometimes means at a general ward. Of course we can give noradrenalin, we know how that works, and we can give certain medications and whatever, but during the nightshift I have fifteen other patients and I can't be by that bedside every ten minutes. That's the problem. That's something we talk about, argue about quite regularly."*
	General ward nurse	*"We have those borderline cases where you think - we can do it, but it's almost impossible at our ward, because we can't check up on those people that often. And we don't have monitoring, so it's not like an alarm sounds when things suddenly turn south. And you just have a number of other patients, that is sometimes the problem. It's not really a matter of being able or allowed to do something, but you just can't handle it because you have so many other patients and then it's just irresponsible to have them lie in the ward without monitoring."*
	ICU nurse	*"Medically speaking the patient is actually well enough to go to the general or the medium care ward, but those wards say: 'guys, we can't handle that one. It's just impossible!' And sometimes that's accepted and usually it isn't. Usually it's like - 'well, not my problem. Needs to be admitted anyway.'"*

DISCUSSION

In this study we identified ethical problems at three different time points during the ICU admission and discharge process: surrounding ICU admission, during ICU stay and surrounding ICU discharge. They can roughly be divided into two categories: those related to full bed occupancy, and those having to do with treatment decisions. Ethical problems connected to full bed occupancy have in common the weighing of interests (and risks and benefits) of two (or more) patients against each other: delay of ICU care for patient A means that patient B benefits from the care he needs, or a transport risk and the inconvenience of a different hospital for patient C mean that patient D can benefit from timely and adequate care. Ultimately, the main dilemma healthcare professionals face is the inability to provide the best care for all patients, and the necessity to choose the best possible alternative.

The second cluster of ethical problems is related to treatment decisions, more specifically the decision whether to start or to stop ICU treatment. In these dilemmas the central question is what is best for an individual patient –*i.e.* weighing of the risks and benefits of different alternatives for the patient in question.

The different nature of the role of nurses and physicians in the patient's care leads to differences in how they perceive and deal with ethical problems. Where physicians predominantly act in a cure role and carry decision-making responsibility when it comes to admitting and discharging patients, nurses work from a care perspective and do not have this responsibility. As we saw in our study, this can lead to a feeling of powerlessness when confronted with an ethical problem nurses cannot "solve" themselves, because they are in close proximity to the patient and his or her family. In situations of doubt or dissension about the start or continuation of treatment, nurses' physical and emotional proximity to patients can provide valuable information about the burden of treatment on a patient or their family, and may provide a counterweight to over-treatment tendencies. But in turn, their continuous exposure to patients' suffering may also lead them to underestimate the chances a patient has of a meaningful recovery.

In several of the ethical problems identified, the concept of medical futility is of relevance. Its exact definition is a point of contention, but one definition commonly used distinguishes three types of medical futility: a treatment can be ineffective, disproportionate, or undesirable[22-24]. As the literature describes, a judgment of the ineffectiveness of treatments is made by physicians. Whether the benefits of treatment are proportionate to its burden should be decided by physician and patient together, since they can assess whether the treatment in question is a reasonable means to reach their goal. Finally, whether the goal of treatment is reasonable is determined by the patient, since this implies a judgment of the value of the life of a patient[23,24]. This seems a clear distinction, but several participants indicate that in practice, this distinction is more difficult to make. They indicated that a judgment of ineffectiveness is hardly ever truly "just" a medical decision.

When describing the ethical dilemmas related to treatment decisions, many participants – especially nurses – address the concern that patients are often treated for too long, or

too intensively. The nature of intensive care appears to encourage over-treatment (rather than under-treatment), through two mechanisms: the technological imperative and anticipated decision regret. As we saw in our results, medical technology often creates its own desirability; its indications are expanded through a mechanism of "what is possible should be done", which is also known as the technological imperative in medicine[25-29]. The ICU environment is especially conducive to this imperative; compared to general wards, there is already a strong focus on highly advanced technology. Because of their illness, patients are often unable to make their wishes known and families (acting as patient proxies) are often unsure about a patient's exact wishes in the given situation, causing healthcare professionals to err on the side of more treatment. In addition, several of the ethical problems described touch on the notion of anticipated decision regret: the fact that people tend to use the concern they will later regret not having intervened as a motivation for intervention (in this case, deciding to (continue to) treat)[30,31]. The nature of the ICU environment makes it important for healthcare professionals to be aware that these mechanisms are in play in their daily work, reflect on why they do what they do, and be mindful of a possible negative impact of over-treatment on their patients. Early discussion of a patient's wishes with regard to treatment options is important in preventing unwanted over-treatment. Research into one manner of giving shape to the registration of treatment wishes, advance care directives, suggests that uptake of this method among the general public is low[32-34]. More research into the optimal approach of discussing and registering treatment limitations at an early stage is needed.

What became clear from our study was the difference between the ICU and the general ward, and its role in the emergence and mitigation of ethical problems. Care in the ICU is more highly technological and more intensive than in the general ward – ICU personnel are more technically skilled than nurses in the general ward. In addition, the nurse to patient ratio in the ICU is much higher than in the general ward, meaning that a general ward nurse will on average spend less time at her patients' bedside than an ICU nurse. Sometimes, the gap between the high level of care the ICU can provide and the lower care level in the general ward leads to mutual misunderstandings: for instance, the ICU staff overestimates the nursing care the general ward can provide, and prematurely discharges patients, substantially increasing the care burden at the general ward. There are several solutions used in practice to bridge the gap between the ICU and general ward and to respond to deteriorating post-ICU patients, such as liaison nurses who coordinate the handover of ICU patients to general wards and who support general ward professionals caring for post-ICU patients who still have complex needs, and outreach teams that provide follow-up to patients recently discharged from the ICU[35]. However, more research into the effectiveness of these interventions is needed.

Our results indicate that when professionals of different wards feel there is a collective effort to solve a problem, a shared responsibility towards achieving the best possible care for the patient(s) in question, and some consideration for the limitations of another ward, this helps to prevent or alleviate moral distress. Interventions that improve the understanding and cooperation between these wards are available, such as short

internships, case discussions of suboptimal handovers between general ward and ICU (and vice versa), and structured feedback methods[36-41]. It is important for ICU and general ward to cooperate well, since they are cogs in the same machine: there is a mutual dependency for optimal patient flow between the different departments.

Study limitations

Our study had several limitations. Any qualitative study carries the risk of eliciting false, socially desirable responses from the interviewees, especially when inquiring after topics in the field of ethics. By asking the participants to describe examples of problems they themselves experienced, we hope to have diminished this risk. The absolute number of participants in our study was relatively small. However, when considering the labor-intensiveness of qualitative research and the suggested number of interviews in the literature, the number of interview and focus group participants was more than required[42]. Additionally, by selecting different types of professionals, from different types of hospitals and different wards, we included a breadth of perspectives, increasing the generalizability of our research.

CONCLUSIONS

The nature of the ICU environment makes it important for healthcare professionals to be aware of the risk of over-treatment, reflect on why they do what they do, and be mindful of a possible negative impact of over-treatment on their patients. Early discussion of a patient's wishes with regard to treatment options is important in preventing over-treatment.

It is important for ICUs and general wards to cooperate well, since there is a mutual dependency for optimal patient flow between the different departments. Interventions that improve the understanding and cooperation between these wards may help mitigate ethical problems.

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Chapter 6

Barriers and facilitators to improve safety and efficiency of the ICU discharge process: a mixed methods study

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BMC Health Services Research: accepted for publication

ABSTRACT

Introduction: Evidence indicates that suboptimal clinical handover from the intensive care unit (ICU) to general wards leads to unnecessary ICU readmissions and increased mortality. We aimed to gain insight into barriers and facilitators to implement and use ICU discharge practices.

Methods: A mixed methods approach was conducted, using 1) 23 individual and four focus group interviews, with post-ICU patients, ICU managers, and nurses and physicians working in the ICU or general ward of ten Dutch hospitals, and 2) a questionnaire survey, which contained 27 statements derived from the interviews, and was completed by 166 ICU physicians (21.8%) from 64 Dutch hospitals (71.1% of the total of 90 Dutch hospitals).

Results: The interviews resulted in 66 barriers and facilitators related to: the intervention (e.g., feasibility); the professional (e.g., attitude towards checklists); social factors (e.g., presence or absence of a culture of feedback); and the organisation (e.g., financial resources). A facilitator considered important by ICU physicians was a checklist to structure discharge communication (92.2%). Barriers deemed important were lack of a culture of feedback (55.4%), an absence of discharge criteria (23.5%), and an overestimation of the capabilities of general wards to care for complex patients by ICU physicians (74.7%).

Conclusions: Based on the barriers and facilitators found in this study, improving handover communication, formulating specific discharge criteria, stimulating a culture of feedback, and preventing overestimation of the general ward are important to effectively improve the ICU discharge process.

INTRODUCTION

Discharging patients from an intensive care unit (ICU) to a general ward is a high-risk event due to the number, complexity and acuity of the patients' medical conditions and the significant reduction in monitoring[1]. Suboptimal clinical handover may result in poor continuity of care and in adverse patient outcomes leading to ICU readmissions and patients' death[2-4]. In the Netherlands, the percentage of ICU readmissions is 7.5%[5], compared to 2.4% to 6.3% in the United States[4,6] and 7.0% in Canada[7]. Of these ICU readmission, percentages ranging from 11.8% to 21.8% are potentially preventable[8,9]. In the Netherlands, reported percentages of in-hospital mortality of ICU patients range from 6.7% to 17.3%[5,10], compared to 4.1% in the United States[6] and 9.4% in Canada[7].
A well-organised ICU discharge process includes the discharge decision, planning and preparation for discharge, safe transport of the patient, and structural follow-up or care after ICU discharge. The organisation of the ICU discharge process differs among

hospitals[11,12]. Moreover, rates of ICU readmissions and post-ICU in-hospital mortality vary between hospitals, indicating room for improving the ICU discharge process.
Factors influencing an effective ICU discharge process are well known[13], and the number of interventions aiming to improve the handover of ICU patients, such as the use of handover forms and liaison nurses, is growing[14]. While the process seems straightforward, implementing quality improvement interventions is very difficult[15]. Systematic understanding of the factors that influence implementation of ICU discharge improvement practices is lacking. Insight is necessary to optimise the use of these practices in daily practice and ultimately to improve patient outcomes.
The purpose of this study was to gain insight into barriers to and facilitators for the implementation and use of ICU discharge practices.

METHODS

Study design and setting

A mixed methods design was adopted, including qualitative methods, individual and focus group interviews, and quantitative methods, an online questionnaire survey sent to all Dutch ICU physicians (n=761) working in all Dutch hospitals (n=90). The questionnaire was used to quantify the results of the interviews. We used the COREQ guideline to design and report the qualitative research (Appendix 6.1)[16].
Hospitals in the Netherlands can be categorised into three types: general, teaching and academic hospitals. The ICUs in the Netherlands are organised in a closed format system with intensivists who coordinate care together with the admitting specialist. Three levels of care are defined, based on annual patient volume, number of ICU beds, number of ventilation days, and physician and nurse staffing[10]. A level 1 ICU has a minimum of six beds and at least two intensivists; level 2 ICUs have a minimum of 12 beds and at least 0.35 full time equivalent (FTE) intensivists and 0.45 FTE house doctors per ICU bed; level 3 ICUs have a minimum of 12 beds and at least 0.45 FTE intensivists and 0.55 FTE house doctors per ICU bed[10,17]. All types of hospital and ICU levels were involved in this study.

Ethical approval

The study protocol was presented to the local Medical Ethical Committee (registration number: 2011/460)[18]. They declared ethical approval was not required under Dutch National Law. All participants received written information about the project, were subsequently invited to participate and gave oral consent. The patients who participated in an interview signed an informed consent form. We stressed that participation in this study was voluntary and withdrawal from the study was possible at any time without consequences. The anonymity of participants and institutions was maintained in the interview transcripts.

Individual and focus group interviews

Before the start of the study, we established contact with ICU physicians in six hospitals: two general, two teaching, and two academic hospitals. Through these six hospital contacts, ICU and ward physicians and nurses, and hospital managers were recruited by email for individual interviews. Before the study started there was no pre-existing relationship between the interviewers and the interviewees. We used a purposive sampling strategy to ensure a representative sample in terms of hospital type (general, teaching, academic), profession (ward nurse, ICU nurse, ward physician, ICU physician), and characteristics such as experience with ICU discharge process and type of generall ward. A consultant of a medical insurance company was recruited from the Dutch umbrella organisation for medical insurance companies. The hospital managers and the employee of a medical insurance company were included to gain insight into possible financial or legal factors. In addition, two post-ICU patients were recruited through the hospital contacts. They were asked to participate by an ICU nurse and were interviewed in the presence of a relative during their stay in a general ward. We stopped including patients after interviewing two patients, because we were not able to gather any information about difficulties related to the ICU discharge process in both patient interviews. A topic guide was developed (Appendix 6.2) and pilot tested with one ICU physician. The individual interviews were conducted by a trained interviewer (NS), in the presence of one other researcher (AO), between April 2012 and December 2012. The number of interviews depended on the point of saturation, i.e., when no new information could be identified in the interviews[19].

To explore the barriers and facilitators identified in the individual interviews more in depth, we conducted four focus group interviews with: (1) ICU physicians, (2) ICU nurses, (3) general ward physicians, and (4) general ward nurses. Recruitment for the focus group interviews took place through snowball sampling: initially the ICU;s and general wards of the six initial hospitals were contacted and through these contacts, physicians and nurses of relevant wards in other hospitals were contacted and invited. The prospective professional participants were informed by email about the objective of the study, and were invited to participate.

The individual interviews with professionals took place at the participants' place of work, the post-ICU patients were interviewed on the general ward, and the focus group interviews took place at a central location. The topic guide for the focus group interviews is included in Appendix 3. The focus group interviews were held in January 2013 and were led by a moderator (HW for focus groups 1 and 2, MZ for focus groups 3 and 4), respectively three (NS, MZ, AO) and two (NS, AO) other researchers were present, both to observe as well as to assist the moderator.

Audio of the individual and the focus group interviews was recorded and subsequently transcribed verbatim, and a note taker was present at the focus group interviews. The transcript of the focus group interviews was sent to the participants for corrections and additional comments.

Questionnaire

The questionnaire contained 27 statements concerning barriers and facilitators for the implementation of improvement practices derived from the findings of the interviews. All statements used in the questionnaire were scored on a 6-point Likert scale ranging from '1 = strongly disagree' to '6 = strongly agree'. A 'not applicable' answering option was also provided. Additionally, the questionnaire contained nine demographic questions and one open-ended question to enable respondents to provide comments. The online questionnaire was designed using LimeSurvey software, and its face validity was tested through two ICU physicians and two independent researchers. This test consisted of completion of the questionnaire and subsequent discussion of the questions together with three of the researchers (AO, NS, MZ).

In March 2013, an introductory e-mail containing the link to the online questionnaire was sent to all ICU physician members of the Dutch Society for Intensive Care (nearly all Dutch ICU physicians are a member of this society, n = 761) working in 90 hospitals, explaining the aim of the study, ensuring the anonymous and confidential handling of data, and inviting them to participate. A reminder was sent two weeks later. Informed consent was implied by completing and sending in the questionnaire.

Data analysis

The interview and focus group transcripts were coded using Atlas.ti 6.2. The analysis was conducted using a framework approach, in which the objectives of the study are already set in advance and are shaped by the information requirements[19]. The framework used was described previously[18], and is based on three models related to implementing change[15,20-22]. The barriers and facilitators found in the interviews were classified into the seven categories of the framework: intervention-related factors (e.g., feasibility), implementation-related factors (e.g., accessibility and support), patient-related factors (e.g., cognition), professional-related factors (e.g., behaviour and attitude), social factors (e.g., leadership and culture), organisation-related factors (e.g., financial resources), and society-related factors (e.g., regulations and laws). To further structure the results of the analysis, the barriers and facilitators were classified into subcategories.

The first five individual interviews were coded by NS, AO and MZ, after which any discrepancies were discussed until consensus was reached. A double analysis (NS and MZ) and subsequent discussion was also performed for the first focus group interview transcript. All other transcripts were coded by one researcher (NS).

The questionnaire results were analysed using SPSS 20. We recoded 'strongly disagree', 'disagree' and 'somewhat disagree' into 'disagree' (0). We recoded 'strongly agree', 'agree' and 'somewhat agree' into 'agree' (1). We ordered the statements in a table, in which 100% was the highest and 0% was the lowest measure of agreement. Subgroup analyses were carried out to study if there were differences in answers between subgroups based on demographic variables, i.e., gender, age, work experience, hospital type, ICU level (level 1 the least advanced ICU and level 3 is the most advanced ICU), and

number of ICU beds, using Pearson chi-square tests and logistic regression. A p-value < 0.05 was considered significant.

RESULTS

Characteristics of participants and respondents

We conducted 23 semi-structured individual interviews (for participant characteristics, see Table 6.1). The interviews took between 11 and 74 minutes; the two patient interviews were relatively short (11 and 13 minutes). All invited persons agreed to participate, except for one ICU physician who declined for scheduling reasons.

Table 6.1. Characteristics of interview and focus group participants

	Individual interviews (n = 23)	Focus group interviews (n = 25)
Job title		
ICU physician (%)	5 (22)	5 (20)
ICU nurse (%)	5 (22)	7 (28)
Ward physician (%)	3 (13)	5 (20)
Ward nurse (%)	5 (22)	8 (32)
Policy maker[a] (%)	3 (13)	0 (0)
Patient (%)	2 (9)	0 (0)
Male (%)	10 (43)	8 (32)
Hospital type		
General (%)	6 (26)	5 (20)
Teaching (%)	4 (17)	10 (40)
Academic (%)	10 (43)	10 (40)
Not applicable[b] (%)	3 (13)	0 (0)
Years of experience in current speciality		
< 5 years (%)	8 (35)	5 (20)
5 – 10 years (%)	5 (22)	7 (28)
> 10 years (%)	5 (22)	13 (52)
Not applicable[c] (%)	5 (22)	0 (0)

We conducted four focus group interviews (see Table 6.1). The focus group interviews took between 60 and 90 minutes. Seventeen ICU physicians were invited, five of whom participated in the focus group interview. Thirty-six general ward physicians were invited, five of whom participated in the interview. Twenty-five ICU nurses were invited, seven of whom took part in the interview. Twenty-five general ward nurses were invited, eight of whom participated in the interview. Most invited participants who declined, declined for scheduling reasons.

Of the 761 ICU physician members of the Dutch Society for Intensive Care, 166 physicians (21.8%) working in 64 different Dutch hospitals (71.1% of the total number of Dutch hospitals) completed the questionnaire. Respondent characteristics can be found in Table 6.2.

Table 6.2. Characteristics of questionnaire respondents

	Respondents (n = 166)
Gender	
Male (%)	106 (63.9)
Female (%)	57 (34.3)
Missing (%)	3 (1.8)
Median Age (min-max)[a]	43 (31-64)
Median years of experience (min-max)[b]	7 (0-34)
Patient category	
Adults (%)	160 (96.4)
Adults and children (%)	6 (3.6)
Hospital type	
General (%)	50 (30.1)
Teaching (%)	70 (42.2)
Academic (%)	45 (27.1)
Missing (%)	1 (0.6)
ICU physician training hospital	
Yes (%)	49 (29.5)
No (%)	112 (67.5)
Missing (%)	5 (3.0)
Median number of ICU beds (min-max)[a]	16 (6-58)

[a] 1 missing

[b] 8 missing

Perceived barriers and facilitators

The participants in the individual and focus group interviews mentioned 66 barriers and facilitators for the implementation of improvement practices of the ICU discharge process (Table 6.3). Most factors were related to the intervention (n = 13), professional (n = 12) and organisation (n = 12). Only one patient-related factor and five factors related to the implementation process were mentioned.

Table 6.3. Perceived barriers and facilitators by the interview respondents

Category	Subcategory	Factor	B	F
Intervention	Credibility	Lack of evidence [0,4,6]	✓	
	Utility	Lack of details in intervention description [B:1,F:1]	✓	✓
	Advantage	Negative (B)/ positive (F) results experienced [B:6,F3]	✓	✓
		(Not) used when (not) useful [B:4,F:3]	✓	✓
		(Not) used when there is (no) need [B:6,8,F:4,5,6,7,8]	✓	✓
	Observability	(No) positive results shown [B:8,F:7]	✓	✓
	Feasibility	Does not work in practice [3,6,7]	✓	
		Not always possible to execute [3,4]	✓	
		Failed pilot test [8]	✓	
		Form not user friendly [4]	✓	
		Uniform policy is impossible [4]	✓	
		Policy tailored to each general ward is not feasible [4]	✓	
		Too many patients [7]	✓	
Implementation process	Accessibility	Intervention not converted into protocol [1]	✓	
		Protocol/policy available on intranet [1,2]		✓
	Clarity	Indistinct agreements surrounding intervention [4]	✓	
	Support	Initiative from care professionals [4]		✓
		Creating support among healthcare professionals		✓
Professional	Attitude	Opinion that intervention is no solution for structural problems [8]	✓	
		Opinion that formulating discharge criteria is (im)possible [B:1,F:1]	✓	✓
		Opinion that intervention is (not) useful [B:3,6,7,F:3,4]	✓	✓
		Negative attitude towards protocols or checklists [1,4]	✓	
		Negative attitude towards new or more forms [0,4]	✓	
		Negative attitude towards registration [0]	✓	
		Opinion that ICU physician is involved until hospital discharge [4]		✓
	Knowledge	Guideline or intervention is unknown [1,7]	✓	
		Physician has little knowledge about nursing discharge practices [3]	✓	
	Awareness	Awareness of possible unsafe practices [0,5]		✓
	Behaviour	Change of routines necessary [0,4]	✓	
	Skills	Lack of ICT skills [0,4]	✓	
Patient	Cognition	Communication impossible [5]	✓	
Social	Leadership	Care professionals are not involved in decision making [0]	✓	
		Prioritization of problem/implementation of intervention [0,8]	✓	
		Choices made in past [8]	✓	
	Culture	(No) culture of feedback [0,4]	✓	✓

		'Ivory tower'-image of ICU [0]	✓	
		Cultural differences between wards [4]	✓	
	Collaboration	No multidisciplinary care [0]	✓	
		No or too little structural consultation with ward [4]	✓	
		Preconceived opinions against ICU professionals [0]	✓	
		ICU nurse performs tasks in general wards [0]		✓
Organisational	Resources	Lack of man-hours/time [0,4,6,8]	✓	
		Ward physician is unavailable [4]	✓	
		Ward equipment is not yet set up [4]	✓	
		Lack of financial resources [8]	✓	
	Structure	Large (B) or small (F) hospital [B:0,7,F:7]	✓	✓
		ICU is 'separated' from hospital by architectural barriers [0]	✓	
		High turnover of physicians [3]	✓	
	ICT infrastructure	(No) hospital wide electronic patient file [B:4,F:4,5]	✓	✓
		No check, no summary as a result of one electronic patient file [4]	✓	
		Electronic patient file unclear/not user-friendly [5]	✓	
		Intervention is connected to electronic patient file [5]		✓
	Policy	Confusion about which physician is responsible for patient [4]	✓	
Society	Financial support	No compensation by insurance company [0,6,8]	✓	
		Cuts are made to minimise expenditures [8]	✓	
		Confusion about financing structures [0,8]	✓	
	Financial incentives	Production is central [0]	✓	
	Regulations	Production instead of quality is performance measure [0]	✓	
		Variation in quality of step down beds due to a lack of policy [8]	✓	
	Other hospitals	Competition [7]		✓
	Professional associations	Discussion whether ICU tasks can and should be performed in general wards by ICU professionals [0]	✓	
		Discussion about the reallocation of ICU tasks to general ward professionals [6]	✓	

[…] = interventions to which the factor is applicable; 0 = General; 1 = Dutch Intensive Care Society (NVIC) guideline; 2 = ICU discharge policies; 3 = Early discharge planning; 4 = Communication at handover; 5 = Medication reconciliation; 6 = Consulting ICU nurse; 7 = Monitoring of post-ICU patients; 8 = Step down beds.
B = Barrier; F = Facilitator.

Intervention-related factors

Barriers mentioned by the interviewees related to the practices themselves were: lack of evidence, lack of details in the practice description, and lack of practical feasibility and applicability.

"In some cases, the patient is ready for discharge early in the morning. If there is room in the receiving ward, the patient will leave a few hours later. Planning the discharge 24 hours in advance is not necessary in these cases." (ICU physician – individual interview)

In the questionnaire, 65.7% of the questionnaire respondents considered planning an ICU discharge at least 24 hours in advance not feasible (Table 6.4). The respondents (77.1%) also thought that practice variation existed due to the lack of specific ICU discharge criteria, 69.3% of the questionnaire respondents would have liked more specific ICU discharge criteria, and 18.1% of the respondents thought it was impossible to set more specific discharge criteria.

"That depends of course on when an ICU physician thinks a patient is not yet recovered enough to go to the general ward. There are no real criteria for that, for when a patient is ready for discharge. So it depends on what an ICU physician thinks whether or not a patient is discharged at that moment."
(ICU nurse – individual interview)

In the interviews, lack of evidence was mentioned. The questionnaire results, however, showed that 74.1% of the respondents thought that little evidence was no barrier to implement an intervention.

Professional-related factors

In the questionnaire, 87.3% of the respondents thought that there was room to improve the communication between the ICU and the general ward. Professional-related factors mentioned in the interviews were a negative attitudes towards checklists, towards more forms and towards registration in general.

"These are things that you have memorised, because you have to work with them every day. You don't need a list for that."
(ICU physician – individual interviews)

Most questionnaire respondents (92.2%), however, considered a checklist useful at handover. A facilitator mentioned in the interviews was the involvement of an ICU physician with the patient until hospital discharge; 25.9% of the questionnaire respondents agreed that an intensivist should be involved with an ICU patient until hospital discharge.

Social factors

Social barriers mentioned by the interviewees were: lack of prioritisation by the management, no culture of feedback, no or little structural consultation with the general ward, and the ICU's 'island' or 'ivory tower' image.

"The ICU still remains a little bit of an island within the hospital. Whenever I have to call the ICU, I think: 'I hope I have my story straight..'."
(Ward nurse – individual interview)

In the questionnaire, 72.9% of the respondents thought that improving the ICU discharge process deserved more attention from the management, 41.0% found that ward professionals did not give feedback when the handover to the general ward was suboptimal, and 74.7% thought that they sometimes overestimated the capabilities of a general ward.

Patient-related factor

The only patient-related factor mentioned by the interviewees was that it is often impossible to communicate with ICU patients.

Organisation-related factors

Organisational barriers mentioned by the interviewees were: large hospital size, no electronic patient file, lack of financial resources, unavailability of the ward physician for face-to-face handover and lack of man hours/time.

"It is bothersome, I think, to figure out who is the physician on the ward. I think that a face-to-face handover would be an improvement, but it costs a lot of time to call six physicians before you've got the right one."
(ICU physician – individual interview)

In the questionnaire, 78.3% deemed an electronic patient file to be indispensable when making an up-to-date medication overview at ICU discharge, 65.1% considered the unavailability of the ward physician a barrier to performing a verbal handover, 49.4% found a lack of financial resources a barrier for implementing improvement interventions, 49.4% thought that it was organisationally impossible to create step down facilities, 45.8% considered monitoring post-ICU patients in general wards infeasible due to a limited number of available nurses, 25.3% regarded the size of their hospital as a barrier to improve the ICU discharge process, and 24.7% considered the amount of available nurses not sufficient for introducing a consulting ICU nurse position.

Society-related factors

One of the society-related barriers mentioned by the interviewees was the financial support by health insurance companies.

"Health insurers should be realistic and make it possible to claim the costs of medium care facilities. At the moment we have no income from the medium care, and that is ridicules."
(ICU manager – individual interview)

In the questionnaire, 49.4% of the respondents thought that a lack of financial resources was a barrier to implementing improvement interventions.

Implementation-related factors
Facilitators mentioned by the interviewees related to the implementation process was availability of protocols (such as handover checklists or discharge criteria) on the intranet and the support among professionals for implementing an ICU discharge practice.

"The general ward worries whether the patient eats enough, whether he tries to stand and walk. We incorporate this in our handover, because they ask about it. But these points are not part of the standard discharge list. This could possibly be improved."
(ICU nurse – individual interview)

In the questionnaire, 23.5% of the respondents stated that they did not have ICU discharge criteria in their ICU.

Ranking
Table 6.4 shows the results of the questionnaire ordered from 100% to 0%. Three statements regarding communication received high rates: 'I think that having a checklist to structure the verbal handover is useful' (92.2% agreed), 'I think that there is room to improve the communication between ICU and general ward' (87.3% agreed), 'I think that performing structured handover takes a lot of time' (78.3% disagreed), and 'I do sometimes overestimate the capabilities of a general ward' (74.7% agreed). Three statements concerning discharge criteria received high rates: 'I think that there are differences among ICU physicians in when they consider a patient ready for ICU discharge, because there are no specific ICU discharge criteria' (77.1% agreed), 'I think it is desirable to set more specific ICU discharge criteria' (69.3% agreed), and 'I think it is possible to set more specific ICU discharge criteria' (74.7% disagreed). Furthermore, 41.0% of the questionnaire respondents disagreed with the statement 'In my experience ward professionals give feedback when the handover to the general ward was suboptimal' and 72.9% agreed with the statement 'Improving the ICU discharge deserves more attention from the management'.

Subgroup analyses
We found significant differences in answers to five statements among respondents in different age categories. For example, significantly more respondents in the category ≤40 years thought that there was room to improve the communication between ICU and general ward than respondents in the category 41-50 years (96.6% vs. 82.6%, p =

0.023). We found significant differences in answers to four statements among respondents in different categories of number of years experience. For example, significantly more respondents with work experience of ≤5 years thought that it was impossible to organise step down facilities than respondents with a work experience of more than 15 years (67.3% vs. 33.3%, p = 0.009). Respondents from academic hospitals and level 2 and 3 ICUs significantly more often concluded that the ICU discharge process deserved more attention from the management than respondents from general hospitals or level 1 and level 2 ICUs (hospital type: academic 86.0% vs. general 61.2%, p = 0.010; ICU level: level 2 83.3% and level 3 78.2% vs. level 1 57.1%, p =0.010 and p=0.024). Respondents from general hospitals had the opinion that they overestimated the possibilities on a ward significantly less often than respondents from academic and teaching hospitals (63.3% vs. an average of 77.0%, p = 0.023). The cross tables of the subgroup analyses can be found in Appendix 6.4.

Table 6.4. Perceived barriers and facilitators by the interview respondents

Category	Subcategory	Statement	Agree (%)	Disagree (%)	NA[a] (%)
P	Attitude	I think that having a checklist to structure the verbal handover is useful.[c]	153 (92.2)	7 (4.2)	6 (3.6)
P	Attitude	I think that there is room to improve the communication between ICU and general ward.[c,g]	145 (87.3)	19 (11.4)	2 (1.2)
I	Resources	I experience enough demand from the ward to implement/sustain the consulting ICU nurse position.	138 (83.1)	20 (12.0)	8 (4.8)
O	ICT infrastructure	I think that when making an up-to-date medication overview at ICU discharge a electronic patient file is indispensable.[d]	130 (78.3)	32 (19.3)	4 (2.4)
I	Utility	I think that there are differences between intensivists in when they deem a patient ready for ICU discharge, because there are no specific ICU discharge criteria.	128 (77.1)	32 (19.3)	6 (3.6)
S	Collaboration	I do sometimes overestimate the possibilities in a general ward.[e]	124 (74.7)	38 (22.9)	4 (2.4)
S	Leadership	I think that improving the ICU discharge process deserves more attention from the management.[e,f]	121 (72.9)	40 (24.1)	5 (3.0)
O	Resources	I think that implementing improvement interventions takes a lot of energy and time.	117 (70.5)	46 (27.7)	3 (1.8)
I	Utility	I think it is desirable to set more specific ICU discharge criteria.	115 (69.3)	48 (28.9)	3 (1.8)
I	Feasibility	I think that planning the discharge of an ICU patient 24 hours in advance is not feasible in daily practice, because the time between the decision to discharge and actual handover is often less than 24 hours.[d]	109 (65.7)	54 (32.5)	3 (1.8)
O	Resources	A major reason for not performing a verbal handover between physicians is the fact that the ward physician is often not available.	108 (65.1)	50 (30.1)	8 (4.8)
S	Culture	In my experience ward professional do give feedback when the handover to the general ward was suboptimal,	92 (55.4)	68 (41.0)	6 (3.6)
O	Resources	I think that a lack of financial resources is a barrier for implementing improvement interventions.	82 (49.4)	79 (47.6)	5 (3.0)
O	Resources	In my opinion it is organisationally impossible to make step down facilities.[d]	82 (49.4)	70 (42.2)	14 (8.4)
O	Resources	I think that because of an insufficient nursing staff it is not	76 (45.8)	83 (50.0)	7 (4.2)

		feasible to monitor post-ICU patient on the wards.[b]			
Sy	Professional associations	I think that relocating ICU tasks to the wards by a consulting ICU nurse is not desirable.[c]	65 (39.2)	100 (60.2)	1 (0.6)
I	Credibility	I think the ICU discharge criteria as described in the NVIC guideline are sufficiently based on scientific evidence.	62 (37.3)	79 (47.6)	25 (15.1)
I	Utility	I think that the ICU discharge criteria as described in the NVIC guideline are unclear.	58 (34.9)	91 (54.8)	17 (10.2)
P	Attitude	I think that intensivists should be involved in care for ICU patients until they are discharged from the hospital.	43 (25.9)	123 (74.1)	0 (0.0)
I	Credibility	If there is no scientific evidence for an intervention, I think that this intervention should not be implemented into daily practice.	42 (25.3)	123 (74.1)	1 (0.6)
O	Structure	I think that the size of my hospital makes it more difficult to improve the ICU discharge process.[c,e,f,g]	42 (25.3)	115 (69.3)	9 (5.4)
O	Resources	I think the current nursing staff is not sufficient for introducing a consulting ICU nurse position.	41 (24.7)	117 (70.5)	8 (4.8)
IP	Accessibility	I've never seen written ICU discharge criteria in our ICU.[c,d]	39 (23.5)	124 (74.7)	3 (1.8)
I	Feasibility	I think that performing structured handover takes a lot of time.	34 (20.5)	130 (78.3)	2 (1.2)
I	Credibility	Because little is known about causes of ICU readmissions, we can't do anything about this problem.	31 (18.7)	134 (80.7)	1 (0.6)
I	Utility	I think it is impossible to set more specific ICU discharge criteria.	30 (18.1)	124 (74.7)	12 (7.2)
P	Attitude	I think that the sickest patient should be the priority of the intensivist. Patients who are almost ready for ICU discharge are of less importance.[f]	21 (12.7)	143 (86.1)	2 (1.2)

NA: not applicable; P: professional; I: intervention; O: organisational; S: social; Sy: society; IP: implementation process.

[a] missing data was also grouped in this category; [b] Answers influenced by gender; [c] Answers influenced by age; [d] Answers influenced by work experience; [e] Answers influenced by hospital type; [f] Answers influenced by ICU level; [g] Answers influenced by number of ICU beds.

DISCUSSION

Main findings and related literature

In this study, 66 barriers and facilitators were found for the implementation of ICU discharge interventions, which were directed towards the intervention itself; the opinion, skills and knowledge of the professional executing the intervention; social factors, such as culture, communication, collaboration and leadership; and factors concerning available resources, organisational structures and ICT infrastructures. Important barriers were related to communication between ICU and general ward professionals, lack of specific discharge criteria and organisational factors, such as lack of priority by the management and cultural factors. Only one patient-related factor was identified. This may have been caused by an inactive role of many patients during transition due to reduced consciousness and a fragile state of health. Implementation-related factors were also limited, because many practices evolved over time and did therefore not have an explicit implementation process.

Almost 90% of the questionnaire respondents concluded that the communication between ICU and general ward could be improved and deserved more attention from the management (72.9%). Patient discharge summaries are an important communication tool which can prioritize or highlight certain information[1]. Kripalani et al. stated that the traditional methods of completing and delivering discharge summaries are suboptimal for communicating timely, accurate, and medically important patient data between hospital-based and primary care physicians[23]. They suggested several steps to improve communication and the quality of discharge summaries by for example computer-generated summaries and standardized formats. Cheung et al. also saw a lack of standardisation as a barrier to optimal handoff between shifts[24]. Checklists are often used to structure and therefore improve the handover communication and over 90% of the questionnaire respondents considered a checklist useful. In the interviews, however, we identified a negative attitude towards checklists as a barrier to implementation and use. The questionnaire respondents' positive attitude towards checklists is in contrast with an interview study of Russ and colleagues, in which resistance and noncompliance from particularly senior clinicians was the most common barrier to using a checklist[25].

The communication between particularly ward nurses and ICU may also have been hindered by the 'ivory tower' or 'island' image of the ICU that the interviewees mentioned. This image is caused by cultural differences between the ICU and the general wards and physical separation of the ICU from the rest of the hospital, and leads to unfamiliarity and misunderstandings. Riesenberg et al. also reported communication barriers related to social structures and hierarchies in a research on nursing handoffs[26]. Lin et al. stated that teamwork involves shared organisational goals and coordination among team members and across teams to improve ICU discharge[13]. IN a later article by Lin et al., they reported that a lack of communication across departments and different teams' competing priorities contributed to ICU discharge delays[27].

This social barrier is also related to the perceived lack of a culture of feedback (i.e., professionals not being held accountable for suboptimal communication) by the questionnaire respondents. The presence or absence of a culture of feedback affects the implementation and use of discharge practices and the quality of handover at ICU discharge in general. Hesselink and colleagues researched hospital discharge, and described that feedback is not always feasible due to, for instance, time constraints, but also because feedback is believed to be inappropriate[28].

According to almost 70% of our questionnaire respondents, more specific ICU discharge criteria are desirable. The current situation, no specific criteria, leads to differences in when ICU physicians deem a patient ready for discharge. A literature review showed that written ICU discharge guidelines are often missing in ICUs, and noted that the guidelines used are often based on consensus instead of empirical evidence[13]. Currently, discharge criteria are mostly geared towards determining when a patient is no longer in need of ICU care. There is, however, a significant gap between when a patient is no longer in need of ICU care and when a patient can be safely cared for in a general ward. ICUs and general wards differ significantly in terms of nurse-to-patient ratio (in other words, how often a nurse can check on the patient), as well as the knowledge and skills that ward nurses need to perform complex nursing interventions[29]. The discharge of a patient from the ICU to a general ward usually means a heavy workload for the ward nurses, and moral distress when they are not able to give each patient in the ward the care he or she needs[30]. The capability of general wards to care for complex patients is not always clear to ICU professionals; in our study, almost 75% of ICU physicians said they sometimes overestimate care possibilities on general wards. This may result in early discharges and adverse events after ICU discharge. The same was found in the discharge from hospital to community care setting: Hesselink and colleagues found that hospital staff was unacquainted with care in the community and did not adequately anticipate the needs of the community care providers[31].

Strengths and limitations

Methodological strengths of this study are the use of a mixed methods approach and a theoretical framework to analyse the interviews[18]. Semi-structured face-to-face interviews were used to explore barriers and facilitators in-depth[19]. In the subsequent focus groups, the group dynamic and interaction among participants helped to further explore and clarify participants' views on barriers and facilitators[19]. To verify the broad exploration of barriers and facilitators in the interviews in a larger group and to quantify the results, we used an online questionnaire[32]. By including different types of professionals and managers from different types of hospitals and different wards in our interviews, we ensured a breadth of perspectives, increasing the generalisability of our research. However, differences in cultures and health systems among countries may negatively impact the generalisability of the results.

Our study had several other limitations. We asked the interview participants about eight practices, which made it difficult to explore all practices in depth in each interview. Furthermore, although almost every professional invited for an individual interview

agreed to participate, only 24% of the professionals invited to the focus groups agreed to participate. This was mainly caused by scheduling, since the focus group interviews were scheduled by the researchers and the individual interviews were planned at the convenience of the participant. Furthermore, the individual interviews took place at the workplace of the participant and the participants in the focus group interviews had to travel to the interview location.

The response rate to the questionnaire of 21.8% was quite modest. However, taking into account the proportion of hospitals with at least one respondent, we included nearly three-quarters of Dutch hospitals. We could not access demographic data of the non-respondents for reasons of confidentiality and were therefore unable to analyse the representativeness of our respondents. Moreover, no postal addresses or telephone numbers were available to us, so we could reach respondents only via email. Therefore, we were unable to increase the response rate by using additional methods to reach out to potential respondents. Although a low-response rate increases the potential for non-response bias, research by Kellerman et al. suggests that the risk of non-response bias may be lower in survey research among physicians than among other populations, possibly since physicians are a relatively homogenous group[33]. In previous studies analysing non-respondents of survey research, non-response bias was suggested in research in which women, recently licensed physicians and younger physicians were more likely to respond[34,35]. Our study population, however, consisted of a varied sample in terms of age, experience and gender.

The interviews with the patients did not result in any findings, mostly because the patient and the relative present were not aware of the different ICU discharge practices. Therefore, we decided to stop including patients after two interviews. This may have influenced the generalisability of the results, because they are mainly based on the health professionals' opinions.

Implications for practice

To decrease practice variation, it is necessary for ICUs to come to an agreement about discharge criteria and the ICU discharge process in general. Capturing these agreements in a guideline could be helpful. The results of this study provide input to improve the existing Dutch national guideline for ICU admission and discharge[36]. An important aspect to consider when evaluating whether or not a patient can be safely discharged is the current capacity of the general ward. Characteristics such as number and skill mix of ward staff, and care burden of other patients already on the general ward need to be taken into account. To avoid overestimation of the capabilities of a general ward by the ICU, agreements should be made between ICU and each general ward on ward-specific discharge criteria. These criteria should be evaluated regularly, as skill mix and resources in general wards may change, in order to ensure the safety of post-ICU patients in general wards.

The communication between ICU and general ward needs to be improved, and in this study, most ICU physicians considered a checklist a useful tool. Structurally evaluating

necessary handover information and communication preferences is of the essence in organising a safe and efficient ICU discharge process[1,23,24].

The process of implementing practices could be enhanced by stimulating a culture of professional feedback, in order to create learning experiences from suboptimal handover situations[28,37]. To decrease the 'island' image of the ICU, to reduce unfamiliarity and misunderstandings and to improve cooperation between ICU and general ward, team training, multidisciplinary meetings, cross-over internships and improvement of leadership could be used[13].

Implications for research

To be able to set specific discharge criteria, more research is necessary to gain knowledge about the characteristics of readmitted patients, but also about organisational processes that may influence and predict readmission. This information is needed to develop a screening instrument to identify patients at risk for readmission or post-ICU mortality. Subsequently, interventions could be developed tailored to these specific groups of high-risk patients to avoid adverse events.

In our research we identified few patient factors influencing the ICU discharge process. The current rise in ICU aftercare, such as support from and visits to the ICU after a patient is discharged home, could be used to gain insight in patient experiences during the ICU discharge process. Their experiences are necessary to optimise the ICU discharge process and to provide continuity of care for these vulnerable patients.

Conclusion

Based on the barriers and facilitators found in this study, improving the handover communication, formulating specific discharge criteria, stimulating a culture of feedback, and preventing overestimation of the general ward are important to effectively improve the ICU discharge process.

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APPENDICES

Appendix 6.1 Consolidated criteria for reporting qualitative studies (COREQ)

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist
Developed from:
Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

No. Item	Guide questions/description	Reported in section
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Interviewer/ facilitator	Which author/s conducted the interview or focus group?	5 (individual and focus group interviews)
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	5 (individual and focus group interviews)
3. Occupation	What was their occupation at the time of the study?	Both interviewers are researchers
4. Gender	Was the researcher male or female?	Both interviewers are female
5. Experience and training	What experience or training did the researcher have?	5 (individual and focus group interviews)
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	5 (individual and focus group interviews)
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	5 (individual and focus group interviews)
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	4 (individual and focus group interviews)
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	6 (data analysis)
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	4-5 (individual and focus group interviews)
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	4-5 (individual and focus group interviews)
12. Sample size	How many participants were in the study?	8 (characteristics of respondents)
13. Non-participation	How many people refused to	8 (characteristics of

	participate or dropped out? Reasons?	respondents)
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	4-5 (individual and focus group interviews)
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	5 (individual and focus group interviews)
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	8 (characteristics of respondents)
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	4-5 (individual and focus group interviews)
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	Not applicable
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	4-5 (individual and focus group interviews)
20. Field notes	Were field notes made during and/or after the interview or focus group?	4-5 (individual and focus group interviews)
21. Duration	What was the duration of the inter views or focus group?	8 (characteristics of respondents)
22. Data saturation	Was data saturation discussed?	5 (individual and focus group interviews)
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	5 (individual and focus group interviews)
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	7 (data analysis)
25. Description of the coding tree	Did authors provide a description of the coding tree?	26 (table 3)
26. Derivation of themes	Were themes identified in advance or derived from the data?	6 (data analysis)
27. Software	What software, if applicable, was used to manage the data?	6 (data analysis)
28. Participant checking	Did participants provide feedback on the findings?	No
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	9-12 (results)
30. Data and findings consistent	Was there consistency between the data presented and the findings?	9-12 (results)
31. Clarity of major themes	Were major themes clearly presented in the findings?	9-12 (results)
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	9-12 (results)

Appendix 6.2 Example of the individual interview guide

Interview Guide ICU physicians

Introduction

Short introduction to the study
Ask permission to record and transcribe the interview
Introduction of researchers and interviewee (name, function title, years of experience)

ICU discharge process

How is the decision to discharge a patient made?
Who is involved?
Is the receiving ward consulted?
Are there set discharge criteria?
If yes, what are they?
If yes, are they used in practice?
If no, on what factors is a decision to discharge a patient based?
Are there non-medical reasons to discharge or to delay a discharge?
Do financial aspects and budget cuts impact discharge decisions?
Are there any financial incentives to discharge a patient early or delay discharge?
What are the agreements with receiving wards?
How and when is the receiving ward informed about the discharge of an ICU-patient?
Are these agreements set?
How does the handover of information between the ICU and receiving ward go?
How does the communication go?
In what way could the handover of information and communication be improved?

Policy

Is policy concerning ICU discharge written down?
If no, why not?
Is the Dutch guideline concerning ICU admission and discharge translated into policy and/or a protocol?
If yes, is it used in practice?
If no, why not?
Is the policy translated into a checklist?
If yes, is it used in every discharge?
If no, why not?

ICU discharge practices

Are step down facilities available in your hospital?
If no, why not?
Does an ICU physician or nurse keep track of the number of available ICU beds?
If no, why not?
If yes, does everyone use this person?
How is this implemented? Are there agreements made with general wards?
Is a recent medication overview made at discharge, which includes allergy information and stopped and changed home medications?
If no, why not?
If yes, is this verified with the patient or his/her relatives?
Are post-ICU patients structurally visited on the ward by an ICU physician or nurse?
If no, why not?
If yes, are all patients visited or only a specific group of patients?
Is advice or help from ICU nurses with certain activities available to the receiving ward ?
If no, why not?

If yes, do all receiving wards use it?
Does your hospital have a medical emergency team or outreach team?
If no, who not?
If yes, do all receiving wards use it?
Are patients discharge earlier due to this intervention?

Concluding
Which factors contribute to a ICU readmission?
What could be improved concerning the discharge of ICU patients?
Do you have suggestions how it could be improved?
What are barriers and facilitators for implementing improvements?

Appendix 6.3 Example of the focus group interview guide

What are the causes of (variation between hospitals in) mortality and readmissions after ICU discharge?
What are solutions to prevent mortality and readmissions after ICU discharge?
Which practices are most effective according to you?
Why are these practices not yet implemented in every hospital? What are barriers and facilitators for implementation and use?

Appendix 6.4 Subgroup analyses

Question 3: 'I think that improving the ICU discharge process deserves more attention from the management.'				
Hospital type	Disagree	Agree	Total	logistic regression (p)
Academic	6 (14.0)	37 (86.0)	43 (100)	0.010
Teaching	15 (22.1)	53 (77.3)	68 (100)	0.052
General	19 (38.8)	30 (61.2)	49 (100)	
Total	40 (25.0) (ref)	120 (75.0)	160 (100)	
Pearson Chi-square (p)	.018			

Question 3: 'I think that improving the ICU discharge process deserves more attention from the management.'				
ICU level	Disagree	Agree	Total	logistic regression (p)
Level 1	15 (42.9) (ref)	20 (57.1)	35 (100)	
Level 2	8 (16.7)	40 (83.3)	48 (100)	0.010
Level 3	17 (21.8)	61 (78.2)	78 (100)	0.024
Total	40 (24.8)	121 (75.2)	161 (100)	
Pearson Chi-square (p)	.017			

Question 4: 'I think that the size of my hospital makes it more difficult to improve the ICU discharge process.'				
Age	Disagree	Agree	Total	logistic regression (p)
=<40 (%)	34 (60.7) (ref)	22 (39.3)	56 (100)	
41-50 (%)	54 (80.6)	13 (19.4)	67 (100)	0.017
>50 (%)	26 (78.8)	7 (21.2)	33 (100)	0.083
Total	114 (73.8	42 (26.9)	156 (100)	
Pearson Chi-square (p)	.033			

Question 4: 'I think that the size of my hospital makes it more difficult to improve the ICU discharge process.'				
Hospital type	Disagree	Agree	Total	logistic regression (p)
Academic	19 (42.2) (ref)	26 (57.8)	45 (100)	
Teaching	56 (80.0)	14 (20.0)	70 (100)	0.000
General	39 (95.1)	2 (4.9)	41 (100)	0.000
Total	114 (73.1)	42 (26.9)	156 (100)	
Pearson Chi-square (p)	.000			

Question 4: 'I think that the size of my hospital makes it more difficult to improve the ICU discharge process.'				
ICU level	Disagree	Agree	Total	logistic regression (p)
Level 1	23 (82.1)	5 (17.9)	28 (100)	0.029
Level 2	44 (93.6)	3 (6.4)	48 (100)	0.000
Level 3	48 (58.5) (ref)	34 (41.5)	82 (100)	
Total	115 (73.2)	42 (26.8)	157 (100)	
Pearson Chi-square (p)	.000			

Question 4: 'I think that the size of my hospital makes it more difficult to improve the ICU discharge process.'				
No. ICU beds	Disagree	Agree	Total	logistic regression (p)
=< 10	32 (94.1)	2 (5.9)	34 (100)	0.001
11-25	55 (78.6)	15 (21.4)	70 (100)	0.003
>25	28 (52.8) (ref)	25 (47.2)	53 (100)	
Total	115 (73.2)	42 (26.8)	157 (100)	
Pearson Chi-square (p)	.000			

Question 5: 'I think that the sickest patient should be the priority of the ICU physician. Patients who are almost ready for ICU discharge are of less importance.'				
ICU level	Disagree	Agree	Total	logistic regression (p)
Level 1	28 (80.0)	7 (20.0)	35 (100)	0.026
Level 2	46 (97.9) (ref)	1 (2.1)	47 (100)	
Level 3	69 (84.1)	13 (15.9)	82 (100)	0.41
Total	143 (87.2)	21 (12.8)	164 (100)	
Pearson Chi-square (p)	.029			

Question 8: 'I think that there is room to improve the communication between ICU and general ward.'				
Age	Disagree	Agree	Total	logistic regression (p)
Age =<40 (%)	2 (3.4) (ref)	57 (96.6)	59 (100)	
Age 41-50 (%)	12 (17.4)	57 (82.6)	69 (100)	0.023
Age >50 (%)	5 (14.3)	30 (85.7)	35 (100)	0.072
Total	19 (11.7)	144 (88.3)	163 (100)	
Pearson Chi-square (p)	.042			

Question 8: 'I think that there is room to improve the communication between ICU and general ward.'				
No. ICU beds	Disagree	Agree	Total	logistic regression (p)
=< 10	9 (22.5) (ref)	31 (77.5)	40 (100)	
11-25	5 (7.1)	65 (92.9)	70 (100)	0.027
>25	5 (9.4)	48 (90.6)	53 (100)	0.089
Total	19 (11.7)	144 (88.3)	163 (100)	
Pearson Chi-square (p)	.045			

Question 9: 'I do sometimes overestimate the possibilities on a general ward.'				
Hospital type	Disagree	Agree	Total	logistic regression (p)
Academic	8 (18.2)	36 (81.8)	44 (100)	0.050
Teaching	11 (16.2)	57 (83.8)	68 (100)	0.013
General	18 (36.7) (ref)	31 (63.3)	49 (100)	
Total	37 (23.0)	124 (77.0)	161 (100)	
Pearson Chi-square (p)	.023			

Question 11: 'I've never seen written ICU discharge criteria on our ICU.'				
Age	Disagree	Agree	Total	logistic regression (p)
=<40 (%)	35 (58.3) (ref)	25 (41.7)	60 (100)	
41-50 (%)	60 (88.2)	8 (11.8)	68 (100)	0.000

>50 (%)	28 (82.4)	6 (17.6)	34 (100)	0.021
Total	123 (75.9)	39 (24.1)	162 (100)	
Pearson Chi-square (p)	.000			

Question 11: 'I've never seen written ICU discharge criteria on our ICU.'				
Work experience	Disagree	Agree	Total	logistic regression (p)
=<5 (%)	34 (56.7)	26 (43.3)	60 (100)	0.000
6-15 (%)	66 (91.7) (ref)	6 (8.3)	72 (100)	
>15 (%)	17 (73.9)	6 (26.1)	23 (100)	0.034
Total	117 (75.5)	38 (24.5)	155 (100)	
Pearson Chi-square (p)	.000			

Question 16: 'I think that planning the discharge of an ICU patient 24 hours in advance is not feasible in daily practice, because the time between the decision to discharge and actual handover is often less than 24 hours.'				
Work experience	Disagree	Agree	Total	logistic regression (p)
=<5 (%)	15 (25.4)	44 (74.6)	59 (100)	0.022
6-15 (%)	32 (45.1) (ref)	39 (54.9)	71 (100)	
>15 (%)	4 (16.0)	21 (84.0)	25 (100)	0.014
Total	51 (32.9)	104 (67.1)	155 (100)	
Pearson Chi-square (p)	.009			

Question 17: 'I think that when making an up-to-date medication overview at ICU discharge a electronic patient file is indispensable.'				
Work experience	Disagree	Agree	Total	logistic regression (p)
=<5 (%)	7 (11.9)	52 (88.1)	59 (100)	0.009
6-15 (%)	23 (31.9) (ref)	49 (68.1)	72 (100)	
>15 (%)	2 (8.7)	21 (91.3)	23 (100)	0.041
Total	32 (20.8)	122 (79.2)	154 (100)	
Pearson Chi-square (p)	.006			

Question 18: 'I think a checklist to structure the verbal handover is useful.'				
Age	Disagree	Agree	Total	logistic regression (p)
=<40 (%)	0 (0.0)	58 (100)	58 (100)	-*
41-50 (%)	7 (10.4) (ref)	60 (89.6)	57 (100)	
>50 (%)	0 (0.0)	34 (100)	34 (100)	
Total	7 (4.4)	152 (95.6)	159 (100)	-*
Pearson Chi-square (p)	.007			

* Impossible to perform logistic regression because of empty fields.

Question 22: 'In my opinion it is organisationally impossible to organise step down facilities.'				
Work experience	Disagree	Agree	Total	logistic regression (p)
=<5 (%)	18 (32.7)	37 (67.3)	55 (100)	0.009
6-15 (%)	34 (49.3)	35 (50.7)	69 (100)	0.166
>15 (%)	14 (66.7) (ref)	7 (33.3)	21 (100)	

Total	66 (45.5)	79 (54.5)	145 (100)	
Pearson Chi-square (p)	.020			

Question 25: 'I think that relocating ICU tasks to the wards by a consulting ICU nurse is not desirable.'				
Age	Disagree	Agree	Total	logistic regression (p)
=<40 (%)	44 (73.3) (ref)	16 (26.7)	60 (100)	
41-50 (%)	40 (58.0)	29 (42.0)	69 (100)	0.070
>50 (%)	16 (45.7)	19 (54.3)	35 (100)	0.008
Total	100 (61.0)	64 (39.0)	164 (100)	
Pearson Chi-square (p)	.023			

Question 26: 'I think that because of an insufficient nursing staff it is not feasible to monitor post-ICU patient on the wards.'			
Gender	Disagree	Agree	Total
Male (%)	58 (58.6)	41 (41.4)	99 (100)
Female (%)	24 (42.1)	33 (57.9)	56 (100)
Total	82 (52.6)	74 (47.7)	156 (100)
Pearson Chi-square (p)	.047		

Chapter 7

General discussion

The pICUp study (Patient handover Intensive Care Unit imProvement) aimed to gain insight into the safety and efficiency of current ICU discharge processes in the Netherlands. This chapter provides a summary of the research questions followed by the main findings. It gives an interpretation of the main findings, followed by the implications for future research. The chapter concludes with recommendations for practice.

RESEARCH QUESTIONS

What is the variation in ICU readmissions and hospital mortality after ICU discharge between ICUs? Chapter 3

What are effective ICU discharge interventions to prevent ICU readmission and hospital mortality after ICU discharge? Chapter 4

Are these interventions used? Chapter 3

What are the barriers and facilitators to the implementation of these ICU discharge interventions? Chapter 5 and Chapter 6

MAIN FINDINGS

Outcome variation between Dutch ICUs

In 2011, there is significant variation between ICUs in the Netherlands in ICU readmissions within 48 hours and in-hospital mortality after ICU discharge, even after case-mix adjustment. The case-mix adjusted (corrected for, amongst others, ICU level, age, and logit transformed APACHE IV mortality probability; see Chapter 4, page 59) ICU readmission within 48 hours after ICU discharge ratios varied between 0.14 and 2.66, and the case-mix adjusted in-hospital mortality after ICU discharge ratios (corrected for, amongst others, ICU level, age and logit transformed APACHE IV mortality probability; see Chapter 4, page 64) varied between 0.07 and 2.07. Although the difference between the minimum and the maximum value in, for example, the standardized readmission rates seems rather small on first sight (0.14 - 2.66), the implications of this variation may be substantial. Hospitals with a ratio of 0.5 or lower have only half of the readmissions which they are expected to have, based on their patient population. In contrast, a few hospitals have a ratio of 2.0 or more, meaning that they have twice as much readmissions than expected. The question is what may be different between hospitals with low scores compared to hospitals with high scores?

Effective ICU discharge practices: liaison nurses and handover forms

The results of our systematic review showed that two interventions significantly improved the ICU discharge process, namely liaison nurses to improve communication and coordination, and handover forms to facilitate timely, complete and accurate handover information. Positive effects were improved continuity of care (for example, reduced discharge delay) and reduced adverse events. Inconsistent effects were observed for use of care; length of stay was reduced, but readmissions increased. Concluding, liaison nurses and handover forms are effective practices and could be used to improve the ICU discharge process.

Practice variation between Dutch ICUs

We showed variation in ICU discharge practices between ICUs in the Netherlands: 28% of the ICUs has step down facilities, 53% uses early discharge planning, 71% uses discharge criteria, 93% uses consulting ICU nurses, and 95% uses bed managers. A consequence of this practice variation is that the approach to patient discharge is affected by factors independent of patient's condition, namely by the ICU discharge practices used in the patient's ICU[1]. The combination of outcome and practice variation could indicate room for improvement to reduce the number of ICU readmissions and deaths after ICU discharge with the ICU discharge process as its key.

No association between ICU discharge practices and patient outcomes

The observed practice variation indicated that the ICU discharge process might play a role in the observed outcome variation. We hypothesised that the use of ICU discharge practices was related to lower ICU readmission or in-hospital mortality ratios. Unfortunately, we did not observe different practices in the hospitals with ratios of 0.5 and lower compared to the other hospitals. Also, we did not observe a difference in patient outcomes between ICUs using less ICU discharge practices compared to ICUs using more ICU discharge practices.

Barriers and facilitators to improve the ICU discharge process

We identified 66 barriers and facilitators related to the ICU discharge practice itself, the healthcare professional, social structures, and the organisation. Barriers considered important by ICU physicians were a lack of feedback culture (55%), an absence of discharge criteria (24%), and an overestimation of the competences of healthcare professionals, of technical possibilities and of the lower nurse-to-patient ratio of a general ward (75%). Furthermore, 88% of the physicians said that communication can be improved, 87% indicated that more specific ICU discharge criteria are desirable, and 73% thought that the ICU discharge process deserves more attention from the management. A checklist to structure the discharge communication was considered important by 92% of ICU physicians.

According to ICU and ward personnel, improvement of the ICU discharge process is possible and necessary. The identified barriers and facilitators are starting points for the improvement of ICU discharge processes.

Ethical dilemmas at ICU admission and discharge

In the context of the ICU admission and discharge process, ethical problems arise at different points in time: when (deciding about) admitting a patient to the ICU from the emergency room, operating theatre or a general ward; during a patient's stay in the ICU; and when (deciding about) discharging a patient from the ICU. Focussing on the latter, an ethical dilemma arises when an ICU patient is at risk of being prematurely discharged to be able to admit a patient in a critical condition to the ICU. In these cases, healthcare professionals are faced with the inability to provide the best care for both patients, and the necessity to choose the best possible alternative.

General ward personnel also can be faced with the inability to provide the best care for a patient, resulting in moral distress. The gap between the ICU and the general ward is often substantial, resulting in suboptimal care for post-ICU patients and mutual misunderstandings and irritation between ICU and general ward staff. In the view of the general ward personnel, the ICU staff sometimes overestimates the technical skills of the ward personnel, and the amount of time and attention the ward personnel is able to give each patient. In those cases, there is no absolute lack of beds in the general ward, but a relative lack of care capacity in relation to the existing care burden.

To prevent or alleviate moral distress surrounding ethical dilemmas amongst ICU or ward personnel the feeling of a collective effort to solve a problem, a shared responsibility towards achieving the best possible care, and some consideration for the limitations of the other ward are important.

INTERPRETATION OF FINDINGS

At the start of this research project we expected to gather the knowledge of how to organise the perfect handover from ICU to the general ward; which steps to take, which interventions to implement, and how to implement them. But alas, we were not able to scientifically prove a link between research discharge practices and improved patient outcomes. And therefore, this thesis does not contain an optimal ICU discharge process. Although, it does provide factors relevant to organise a good handover for a specific ICU. By researching these factors in the context of their own ICU discharge process, individual ICUs may be able to develop a process tailored to their specific patients, professionals and setting.

Our findings contribute to a better insight into the variation in ICU discharge processes and outcomes between ICUs in the Netherlands. We found variation both in discharge practices and in outcome measures. This may indicate room to improve the ICU discharge process, which might subsequently decrease negative patient outcomes.

In the models for case-mix correction (see Chapter 4, page 64) used for both ICU readmission as well as in-hospital mortality we used the APACHE IV mortality probability. Currently, the APACHE IV is the best performing model for case-mix-correction for in-hospital mortality following ICU admission in the Netherlands[2,3]. For

ICU readmissions, however, no good performing case-mix correction model was available, and therefore we used the APACHE IV mortality probably to correct for case-mix in this outcome measure as well. Disappointingly, the calibration of the models for both outcome measures and the discrimination of the model for ICU readmission were poor, and one could argue that conclusions derived from these analyses may not be valid.

In our opinion it may not be necessary to optimally correct ICU readmission and mortality rates for case-mix differences when the results are used for improvement purposes alone. To strive for optimal correction may prove to be a barrier and a delay to start improving our quality of care. It can always provide an excuse to do more research and to delay actually taking action. Measuring ICU readmission rates, correct them for obvious case-mix differences, compare them with other hospitals, stimulating a learning environment, and organising site visits to best practices may prove to be more effective than optimising case-mix correction models.

On the other hand, it is unwise to start 'improvements' solely based on results from analyses without excellent case-mix correction, because it may prove to be incorrect and valuable resources may be wasted. The results from these analyses should be seen as 'flags of interest', which need further analysis, quantitative or qualitative, to indicate if improvement is necessary.

The interviews with professionals provided us with information on relevant in-depth factors influencing the ICU discharge process. Factors such as culture, cooperation and communication, a team spirit in which both ICU and general ward professionals are included, and an environment in which giving and receiving feedback is safe appeared to be very significant to organise optimal ICU discharges. Barriers to optimal handover often lie within these 'soft' factors and they are not always easily measurable. To improve ICU discharge practices of individual ICUs, the processes should be analysed individually and from multiple perspectives to find soft factors hindering optimal ICU discharge. The barriers and facilitators observed provide hospital management and professionals with the starting points to review, discuss and improve their ICU discharge process.

IMPLICATIONS FOR FUTURE RESEARCH

Despite handover being an important topic for the World Health Organization[4], and national government agencies, such as the Joint Commission, the systematic review (Chapter 3) highlights the absence of evidence on how to improve patient handovers between the ICU and general wards. Our hope is that our systematic review will act as a stimulus to gather more evidence on the interventions described in the studies included in the review, as well as interventions evaluated in other settings, such as the handover between hospital and primary health care providers[5]. The implementation of interventions for which insufficient evidence is available may result in wasting valuable

resources. We recommend that researchers and clinicians considering to evaluate an intervention, use robust designs to strengthen the quality of evidence. Designs as randomised controlled trials or cluster randomised controlled trials often pose serious difficulties, but other designs, such as interrupted time-series or controlled before-and-after studies are more feasible in practice and provide a wealth of information about how to improve and what works best.

One of the reasons described for the lack of effects in the studies included in the systematic reviews was a suboptimal research population, such as a low baseline mortality rate[6]. Identifying patient groups with an increased risk of ICU readmission or post-ICU mortality is therefore necessary to more effectively evaluate ICU discharge interventions. However, a systematic review of tools to predict severe adverse events following patient discharge from the ICU concluded that further evaluation of existing ICU readmission scores is required[7]. Therefore, identification of an high risk group for ICU readmissions may not be easy.

To get a grip on the active ingredients of an optimal ICU discharge process and subsequently use these to improve discharge processes, more research on organisational factors influencing ICU readmission and mortality rates is necessary. For example, team climate was not subjected to research in this study, but may play an important role.

IMPLICATIONS FOR PRACTICE

In this thesis we found practice as well as outcome variation, which may suggest room to improve the ICU discharge process. Unexplained practice variation between the Dutch ICU discharge processes can only be addressed on a national level. A national guideline describing effective ingredients of the ICU discharge process may reduce unacceptable variation. Scientific literature is, however, not providing us with effective ICU discharge interventions for national implementation. On the other side, three quarters of the ICU physicians indicated that a lack of scientific knowledge is no barrier for implementing interventions. Based on this finding, the ingredients of the ICU discharge process could be based on consensus complemented with scientific evidence.

Factors influencing readmission rates and mortality after ICU discharge might differ between hospitals. Researching these factors in each hospital gives management insight in how to reduce the number of ICU readmissions and post-ICU in-hospital mortality. In this research process, it is meaningful to devote particular attention to the ICU discharge process. Thereby, one should be aware of a cultural gap between ICU and general ward. To improve communication and cooperation between ICU and general wards interventions such as team training, multidisciplinary meetings and short internships could be useful. Other suggestions for improvement strategies can be found in Table 7.1.

These interventions to improve communication and cooperation may also help mitigate ethical problems.

It is important for ICUs and general wards to cooperate effectively, since there is a mutual dependency for optimal patient flow between the different departments. Discharge criteria should be geared towards determining if a patient can be safely cared for on a specific general ward instead of determining if a patient is no longer in need of intensive care. In these discharge criteria, factors such as nurse-to-patient ratio on the general ward, knowledge and skills of ward nurses, and workload should be taken into account and evaluated with each discharge decision as they may change with each shift. These discharge criteria may decrease overestimation of care possibilities on general wards by ICU professionals and prevent early ICU discharges, ICU readmissions and adverse events after ICU discharge.

A handover from ICU to ward is a high-risk event. Patients undergo a significant transition in care. They leave the ICU where medical care is intensive and resources are rich, and to a general ward where patient receive much less intensive monitoring and patient care[5,8]. But all handovers, between shifts, between hospital wards, and trans-mural handovers, are more or less risky for patients in which a wide range of things may go wrong. From a patient's perspective, a patient should be cared for by one team, familiar with his condition, personal wishes and family, during his entire hospital stay. Experts treating his different conditions reinforce the team when necessary. As a result, less risky handovers are needed. Currently, there is much attention for alternatives for the current organisation of care. For example, the results of integrated care are promising[9].
In the meantime, all healthcare professionals have to keep in mind that all handovers could have a negative effect on the patient's well-being if performed badly, hastily or unfocussed. Because we, healthcare professionals and management, organise healthcare into institutions, wards and shifts, it is our duty to prevent adverse events during or as a result of ICU discharges and all other handovers, and to discharge or hand-over patients with care.

Table 7.1. Matrix with improvement strategies based on found barriers

Classification barrier		**Description barrier**	**Improvement strategy**
Category	**Subcategory**		
Social	Leadership	Lack of attention for improving the ICU discharge process of the management.	Use of opinion leaders to engage management in designing and implementing improvement interventions.
Social	Collaboration	The ICU professionals overestimate the possibilities (number of personnel and skills) on general wards.	Meetings and site visits aimed at identifying capabilities and needs of general wards. Structural feedback on personnel status (number and skill-mix) of general wards.; Consult and support of general wards by ICU.
Professional	Attitude	Different focus of the ICU and general wards.	Meetings and site visits aimed at identifying capabilities and needs of ICU and general wards.
Social	Collaboration	Gap between the high level of care the ICU can provide and the lower care level in the general wards, leading to misunderstandings.	Meetings between ICU and general ward personnel aimed at increasing the mutual understanding and respect between both groups.
Society	Professional associations	Unclear discharge criteria in the guideline.	Revising the guideline using in close cooperation with healthcare professionals.
Social	Culture	Lack of feedback about ICU discharge performance.	Team training aimed at creating a culture in which ICU and ward personnel ask for feedback and give feedback about the ICU discharge process.
Social	Cooperation	Physician of general ward is not always available for verbal handover.	Meetings with ICU and general ward personnel to set common goals (improvement of ICU discharge) and change objectives.

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Summary

Summary

This thesis aims to gain insight into the safety and efficiency of current ICU discharge processes in the Netherlands, and subsequently, to find interventions and relevant barriers and facilitators to efficiently and effectively improve the ICU discharge process. For that purpose we investigated: 1) the variation in ICU readmissions within 48 hours and in-hospital mortality after ICU discharge between Dutch ICUs; 2) effective ICU discharge interventions to prevent ICU readmissions and hospital mortality after ICU discharge; 3) the use of effective interventions; and 4) barriers and facilitators to the implementation and use of these ICU discharge interventions.

In *Chapter 1* we described the relevance of clinical handover in general en clinical handover from the ICU in particular. Clinical handover can be divided into four phases; decision making, planning and preparation, patient transport, and follow-up. Clinical handover is internationally acknowledged as an essential component of quality and care, and as a high-risk episode in the care process of many patients. Suboptimal clinical handover is especially dangerous for ICU patients; it results in poor continuity of care and in adverse patient outcomes.

In *Chapter 2* we showed our research protocol which we used to investigate the research questions. We used a theoretical framework of the process of implementation of scientific evidence and the categories of factors influencing this process, such as professional characteristics. The frameworks is based on the frameworks of Cahill, of Cabana and the framework of Grol and Wensing.

In *Chapter 3*, we analysed the rates of ICU readmissions within 48 hours after ICU discharge and the rates of in-hospital deaths after ICU discharge of each hospital participating in the Dutch National Intensive Care Evaluation (NICE) database, and visualised the variation in funnel plots. In both case-mix adjusted readmission and mortality ratios, we found variation. The implications of this variation may be substantial: the hospitals with a ratio of 0.5 or less had half as much readmissions or deaths as was expected (based on case-mix), hospitals with a ratio of 2.0 or more had twice as much readmissions or deaths as expected. This may indicate that the quality of the ICU discharge processes varies between Dutch hospitals. By researching the differences between hospitals with high ratios and low ratios and creating a learning environment, the quality of care when discharging an ICU patient in the Netherlands may be increased.

In *Chapter 3* we also described the results of the questionnaire send to Dutch hospitals participating in the NICE database. The questionnaire concerned eight ICU discharge practices commonly used in the Netherlands, and we asked the ICUs whether or not they incorporated each of the practices in their ICU discharge process. We found variation in the use of the discharge practices between the ICUs. The combination of outcome variation – differences in ICU readmission and mortality rates – and practice variation – differences in ICU discharge processes – indicates unexplained variation within the ICU

discharge process. It suggests room for improvement to reduce the number of ICU readmissions and deaths after ICU discharge by improving the ICU discharge process.
The results of the questionnaire were analysed in combination with the readmission and mortality rates from the NICE database in order to determine if certain practices in the ICU discharge process were related to less readmissions or deaths after ICU discharge. Unfortunately, we did not observe different practices in the hospitals with low ratios compared to other hospitals.

In *Chapter 4* we described the findings of the systematic review of the scientific literature. We searched for practices which significantly improved the quality of the ICU discharge process and identified 11 articles. Six articles described an observed significant effect of the intervention researched. In the other five, no significant effects could be identified. Interventions showing significant effects included liaison nurses and handover forms. However, most studies were of poor methodological quality, which made it difficult to draw firm conclusions.

In *Chapter 5* and *Chapter 6* we described the findings of the individual and focus group interviews with post-ICU patients, nurses and physicians of the ICU, nurses and physicians of the general wards, and managers. The interviews resulted in 66 barriers and facilitators for implementation and use of ICU discharge practices. Important barriers were related to communication between ICU and general ward professionals, lack of specific discharge criteria and organisational factors, such as lack of priority by the management and cultural factors. In the same individual and focus group interviews we identified and explored ethical dilemmas healthcare professionals are faced with. Also in this analysis cultural differences between ICU and general wards – which may result in misunderstandings and irritation – and decreased cooperation and communication between healthcare professionals were found to be barriers to optimal care. The qualitative results of the interviews were quantified using a questionnaire containing statements based on the found barriers and facilitators. Barriers considered important were a lack of feedback culture (55%), an absence of discharge criteria (24%), and an overestimation of the competences of healthcare professionals, of technical possibilities and of the lower nurse-to-patient ratio of a general ward (75%). Furthermore, 88% said that communication can be improved, 87% indicated that more specific ICU discharge criteria are desirable, and 73% thought that the ICU discharge process deserves more attention from the management. A checklist to structure the discharge communication was considered important by 92%.

In *Chapter 7*, the results of our studies are discussed, and we reflect on the interpretation of the findings in the context of methodological issues. Implications for future research and implications for practices are presented. The results of our studies show the complexity of the ICU discharge process and the variety in process and patients outcomes between Dutch ICU's. The variation in both process and outcomes may indicate room to improve the ICU discharge process. However, our systematic

review did not result in clearly effective interventions to do this. Our qualitative studies provide a deeper insight in the factors influencing the quality of the ICU discharge process, which focuses on communication, cooperation and organisation. This thesis provides healthcare professionals and management with starting points to reflect on their own ICU discharge process, to research possible weaknesses in this process, and to develop a tailor-made improvement plan.

Samenvatting

Dit proefschrift had als doel om de veiligheid en de efficiëntie van de huidige IC-ontslagprocedure in Nederland te verbeteren, door effectieve werkwijzen en relevantie belemmerende en bevorderende factoren om de IC-ontslagprocedure in kaart te brengen. Vanuit deze doelstelling hebben we onderzocht: 1) de variatie in IC-heropnames en ziekenhuismortaliteit na IC-ontslag tussen Nederlandse IC's; 2) effectieve IC-ontslagwerkwijzen om IC-heropname of ziekenhuissterfte na IC-ontslag te voorkomen; 3) in welke mate deze werkwijzen worden gebruik in de praktijk; en 4) en welke factoren het gebruik van de werkwijzen belemmeren en bevorderen.

In *Hoofstuk 1* hebben we de relevantie van medische en verpleegkundige overdracht in het algemeen en overdracht voor de IC specifiek beschreven. Een overdracht kan ingedeeld worden in vier fases; besluitvorming, planning en voorbereiding, transport van de patiënt, en follow-up. De medische en verpleegkundige overdracht is internationaal erkend als een essentieel onderdeel van kwaliteitszorg en als een hoog risicomoment in het zorgproces van veel patiënten. Suboptimale medische en verpleegkundige overdracht is met name gevaarlijk voor IC-patiënten; het resulteert in slechte continuïteit van zorg en in slechtere patiëntuitkomsten.

In *Hoofdstuk 2* is ons onderzoeksprotocol beschreven, wat we gebruikt hebben om de onderzoeksvragen te onderzoeken. We hebben een theoretisch raamwerk gebruikt dat het implementatieproces beschrijft van wetenschappelijk bewijs en categorieën van factoren die het proces beïnvloeden, zoals professionele kenmerken. Het raamwerk is gebaseerd op de raamwerken van Cahill, van Cabana en het raamwerk van Grol en Wensing.

In *Hoofdstuk 3* hebben we de ratio IC-heropnames binnen 48 uur na IC-ontslag en de ziekenhuissterfte na IC-ontslag van elk ziekenhuis, dat aan de Nederlandse IC-evaluatie (NICE) database deelneemt, geanalyseerd. De resultaten hebben we vervolgens gevisualiseerd in funnel plots. In beide casemix-gecorrigeerde heropname- en mortaliteitratios vonden we variatie. De implicaties van deze variatie kan substantieel zijn: de ziekenhuizen met een ratio van 0.5 of minder hebben half zoveel heropnames of sterfgevallen dan verwacht (gebaseerd op casemix), ziekenhuis met een ratio van 2.0 of meer hadden twee keer zoveel heropnames of sterfgevallen dan verwacht. Dus maakt het uit in welk ziekenhuis een patiënt is behandeld. Wat doen de ziekenhuizen met ratio's lager dan 0.5 zoveel beter dan ziekenhuizen met hoge ratio's? Onze hypothese was dat de ziekenhuizen met ratio's lager dan 0.5 bepaalde werkwijzen in hun IC-ontslagproces hadden opgenomen, die de andere ziekenhuizen niet hadden.

In *Hoofdstuk 3* beschreven we de resultaten van de vragenlijsten die gestuurd zijn naar alle Nederlandse ziekenhuizen die deelnemen aan de NICE-registratie. De vragenlijst had betrekking op acht IC-ontslagwerkwijzen die met enige regelmaat toegepast worden in Nederland, en we vroegen de IC's of ze deze werkwijzen hadden opgenomen in hun IC-ontslagproces. We vonden variatie in het gebruik van de ontslagwerkwijzen tussen de

IC's. De combinatie van uitkomstvariatie – verschillen in heropnames en sterftecijfers – en praktijkvariatie – verschillen in de IC-ontslagprocessen – wijst op onverklaarde variatie in de IC-ontslagprocessen. Het IC-onstlagproces zou een rol kunnen spelen in de geobserveerde uitkomstvariatie, wat wijst op ruimte voor verbetering om het aantal IC-heropnames en sterftes na IC-ontslag te verminderen.
De resultaten van de vragenlijst zijn samen met de IC-heropname- en mortaliteitratio's uit de NICE-database geanalyseerd om vast te kunnen stellen of bepaalde werkwijzen gerelateerd waren aan minder IC-heropnames of sterfte na IC-ontslag. Helaas hebben geen verschillen geobserveerd wat betreft werkwijzen tussen ziekenhuizen met lage ratio's ten opzichte van andere ziekenhuizen.

In *Hoofdstuk 4* hebben de bevindingen van een systematische review van de wetenschappelijke literatuur beschreven. We hebben gezocht naar werkwijzen welke de kwaliteit van het IC-ontslagproces significant verbeterde, en we vonden 11 artikelen. Zes artikelen beschreven een geobserveerd significant effect van de onderzochte werkwijze. In de andere vijf werden geen significante effecten geobserveerd. Werkwijzen die significante effecten lieten zien waren liaison verpleegkundigen en overdrachtsformulieren. Echter, de meeste studie waren van slechte methodologische kwaliteit, wat het moeilijk maakte om harde conclusies te trekken.

In *Hoofdstuk 5* en *Hoofdstuk 6* hebben de bevindingen uit de interviews met post-IC-patiënten, verpleegkundigen en artsen van de IC, verpleegkundigen en artsen van ontvangende afdelingen, en managers beschreven. De interviews resulteerde in 66 belemmerende en bevorderende factoren voor de implementatie en het gebruik van IC-ontslagwerkwijzen. Belangrijke belemmerende factoren waren gerelateerd aan communicatie tussen de professionals van de IC en de ontvangende afdeling, het afwezig zijn van specifieke ontslagcriteria, en organisatiefactoren, zoals dat het IC-ontslagproces door het management niet als prioriteit gezien wordt. In dezelfde individuele en focusgroep-interviews werden ook ethische dilemma's verkend en geïdentificeerd waarmee professionals te maken krijgen. Ook in deze analyse werden culturele verschillen tussen de IC en de ontvangende afdelingen – welke kunnen resulteren in misverstanden en irritaties – en een verminderde samenwerking en communicatie tussen professionals van de IC en de ontvangende afdelingen gevonden als belemmerende factoren voor optimale zorg. The kwalitatieve resultaten van de interviews werden gekwantificeerd met behulp van een vragenlijst welke stellingen bevatte gebaseerd op de gevonden belemmerende en bevorderende factoren. Belemmerende factoren die belangrijk werden geacht waren het afwezig zijn van een feedback-cultuur (55%), het afwezig zijn van ontslagcriteria (24%), en een overschatting van de mogelijkheden van de professionals, de technische mogelijkheden en de lagere verpleegkundige-patiënt-ratio op de ontvangende afdeling (75%). Verder zei 88% dat de communicatie verbeterd zou kunnen worden, 87% gaf aan dat specifiekere IC-ontslagcriteria wenselijk zijn, en 73% dacht dat het IC-ontslagproces

meer aandacht verdiend van het management. Een checklist om ontslagcommunicatie te structureren werd door 92% als belangrijk gezien.

In *Hoofdstuk 7* worden de resultaten van de studies bediscussieerd en wordt gereflecteerd op de interpretatie van de bevindingen in relatie tot methodologische vraagstukken. Suggesties voor vervolgonderzoek en aanbevelingen voor de praktijk worden gepresenteerd.

De resultaten van onze studies laten de complexiteit van het IC-ontslagproces en de variatie in het proces en de uitkomsten ervan tussen Nederlandse IC's zien. De variatie in zowel het proces als de uitkomsten kan op ruimte voor verbetering wijzen. Echter, onze systematische review resulteerde niet in een effectief pakket van werkwijzen om dit te doen. Onze kwalitatieve studies verschaffen een dieper inzicht in de factoren die invloed hebben op de kwaliteit het IC-ontslagproces, welke zich focussen rondom communicatie, samenwerking en organisatie. Dit proefschrift verschaft zorgprofessionals en management met aanknopingspunten om te reflecteren op hun eigen IC-ontslagproces, mogelijke zwakke punten in dit proces te onderzoeken, en een passend verbeterplan te ontwikkelen.

Dankwoord

Zie hier mijn proefschrift. Het is klaar. Aangezien je een proefschrift niet alleen schrijft, wil ik dit laatste hoofdstuk graag gebruiken om een aantal mensen te bedanken die mij op verschillende manieren tijdens mijn promotietraject hebben gesteund. Zonder hen was mijn promotie niet mogelijk geweest.

Om te beginnen mijn promotoren, Hans van der Hoeven en Gert Westert, en mijn twee copromotoren, Marieke Zegers en Hub Wollersheim. Dankzij jullie kon ik promoveren op een zeer interessant en belangrijk onderdeel van het zorgproces voor de kwetsbaarste mensen in het ziekenhuis. Ik heb heel veel van jullie geleerd en ik wil jullie bedanken voor jullie tijd en moeite om dit project tot een succesvol einde te brengen.

Hans, jouw visie als ervaringsdeskundige van de overdracht tussen IC en afdeling was onmisbaar in dit project. De bevindingen werden door jou betekenis gegeven en gaven kleur en extra relevantie aan dit onderzoek. Gert, bedankt voor je steun, met name in de laatste fase van dit promotietraject. Het was niet altijd makkelijk, maar met jouw praktische tips, wijsheden en met jouw vertrouwen kon ik weer vol goede moed aan de slag. Hub, jouw kennis en ervaring in de onderzoekswereld is onontbeerlijk en een grote steun gebleken. Tijdens mijn studie Biomedische Wetenschappen zijn we in contact gekomen via een keuzevak. Via jou heb ik IQ healthcare en Marieke leren kennen en is mijn promotietraject mogelijk geworden.

Marieke, na mijn afstuderen deed jij me meteen een aanbod om met dit promotietraject te beginnen. En door de fijne samenwerking die wij al hadden was de keuze om in te gaan op dit aanbod snel gemaakt. ik denk dat jij jouw taak als eerste copromotor meer dan waar hebt gemaakt. Ik kon altijd bij je terecht voor alle vragen, om te brainstormen en om mijn hart te luchten. Of we het nu eens waren of niet, we zijn er altijd uit gekomen. Ik heb je onwijs gemist in de periodes dat je (twee keer!!) met zwangerschapsverlof was. Ik ben blij dat ik je eerste promovendus mocht zijn.

Leden van manuscriptcommissie, prof. dr. van Laarhoven, prof. dr. van der Voort en prof. dr. Vermeulen, bedankt voor het lezen en beoordelen van mijn proefschrift.

Voor de resultaten van de onderzoeken in dit proefschrift zijn een groot aantal zorgverleners en patiënten bereid geweest om deel te nemen aan individuele interviews, groepsinterviews of aan vragenlijsten. Zonder hun deelname en openhartigheid zou dit proefschrift er niet zijn geweest.

Nicolette en Rebecca, bedankt voor jullie hulp en adviezen vanuit NICE. Data uit de database door jullie samengesteld en onderhouden is de basis geweest voor dit proefschrift. Daarom ben ik ook dank verschuldigd aan alle medewerkers van de Stichting NICE en alle deelnemende ziekenhuizen.

Ferishta, jouw kennis van de NICE-database en statistische analyses hebben mijn diepe respect. Zonder jou was het variatie-artikel onmogelijk geweest. Daarnaast wil ik bedanken voor de fijne samenwerking. Je stond altijd meteen klaar als er weer een revisie nodig was. Je hebt me altijd het gevoel gegeven dat het een gezamenlijke missie was om dit artikel gepubliceerd te krijgen.

Anke, ik heb onwijs veel van je geleerd als het gaat om kwalitatief onderzoek en ethiek. Ik vond jouw deel van de interviews vaak interessanter dan die van mij.. Niet doorvertellen! Als collega heb ik vaak een beroep op je gedaan voor advies. Je stond altijd klaar.

Gijs, je hebt me alles geleerd over het doen van een systematic review. Mijn stagiaires bij Zinzia hebben daar nu weer profijt van. Door jouw kennis en inzet is ons artikel gepubliceerd in een goed tijdschrift. Samenwerken met jou kan ik iedereen aanraden!

Yvonne, bedankt voor jouw vasthoudendheid om de response rate van de vragenlijst tot een bijna onmogelijk percentage (91,4%!!) te verhogen. Ik hoop dat mensen zich niet gestalked voelden..

Lieve collega's van IQ healthcare en alle verschillende kamergenoten die ik heb gehad. Met plezier naar je werk gaan heeft volgens mij voor een groot deel te maken met je collega's. Ik heb ontzettend genoten van het samen werken met jullie. Ook al hadden we allemaal andere projecten, veel antwoorden op vragen heb ik via jullie gekregen. Ik heb veel van jullie geleerd. Ook zaten we natuurlijk allemaal in het zelfde promotie-schuitje, met al zijn ups en downs. Ik heb bij jullie mijn ei kwijt gekund en daardoor zijn jullie mij onwijs tot steun geweest. Daarnaast hebben we ook super veel gelachen, wereldproblemen bediscussieerd in de pauze, boer-zoekt-vrouw-pools en touwtjespringwedstrijden gehouden, filmavonden met pizza, met de feestcommissie een avond bowlen met de hele afdeling organiseren (inclusief medailles), deelgenomen aan pubquizen (als team IQkeleQ ofzo?), DoMiBo's, enzovoorts. Juliette, je humor is ongeëvenaard. Yvonne, altijd fijn bijpraten met jou. Berend T. zal ons blijven verbinden. Annelie, door jou weet ik dat voor Fransen de Walen net zo vreemd klinken als de Vlamingen voor ons. Dat vroeg ik me altijd al af. Ellen, jouw rustige karakter is een fijne en belangrijke tegenhanger van het kippenhok bij IQ. Jan, ik heb wat tijd nodig gehad om je 'door' te hebben, maar je bent geweldig! Guus, sorry voor alle vrouwenpraat over boer zoekt vrouw. Dat geldt overigens ook voor Jan. Marieke (de Jonge), onze gezamenlijke liefde voor Pinterest deed me vaak even bij je binnenlopen. Myrna, Jasper, Jan, jullie speciale dank als medevoorzitters van Schil. Ik vond het heel speciaal dat we samen onze promovendi-collega's mochten vertegenwoordigen.

Saskia en Wytske, als paranimfen en lieve vriendinnen krijgen jullie natuurlijk een eigen plekje. Wytske, je bent lief en positief, en vrienden zijn met jou voelt voor mij als vanzelfsprekend. Naast werkgerelateerde dingen hebben we ook de rest van de dingen

die ons bezighouden kunnen delen, van verdrietig en irritant tot mooi en spannend. Ik ben blij dat je weer in de buurt woont. Saskia, omdat we tegelijk begonnen waren we tot elkaar veroordeeld. En tot de Barak Obama.. Door alle ontberingen die we samen hebben moeten doorstaan zijn we hecht geworden. Je was een opmerkelijke verschijning bij IQ, met een andere achtergrond en interesses. Je hebt mijn blik verruimt. Mijn dank daarvoor.

Collega's van Zinzia, het leuke is dat door jullie en mijn werk bij Zinzia mijn kijk op dit proefschrift is verdiept, ondanks dat het op het eerste gezicht misschien weinig met elkaar van doen heeft. Dank voor jullie vertrouwen in mij, ondanks mijn korte CV.

Sabine en Marieke, jullie zijn de beste vriendinnen die ik me zou kunnen wensen. We kunnen samen lachen en huilen en ondanks dat we uitersten zijn op het gebied van sportiviteit (jullie 100 en ik 0) past het toch onwijs goed. Jullie zijn te gek!

Pa en Ma, zonder jullie geen Nelleke, geen ik zoals ik nu ben en dus ook geen proefschrift. Jullie hebben me gevormd en altijd gesteund in mijn keuzes. Ondanks de lastige tijden zijn we er nu weer allemaal bovenop en kunnen we, na de bruiloft van Joost en mij, ook weer dit feestje vieren.

Marinus en Ties, mijn lieve broertjes (ja, nog steeds..), getuigen, irritatiefactortjes en steunpilaren. Jullie zijn een voorbeeld, staan altijd voor mij klaar, zijn een spiegel voor me en nog veel meer. Ik houd ontzettend veel van jullie!

Joost, mijn liefde en nu ook mijn man. We hebben elkaar in een voor mij lastige tijd leren kennen, maar ondanks de prille liefde heb jij me daar doorheen geholpen. Jouw nuchtere kijk, luisterend oor en rake adviezen hebben ook gezorgd dat ik mijn promotie heb kunnen en willen afronden. Je bent mijn alles.

Curriculum Vitae

Nelleke van Sluisveld werd op 18 november 1986 geboren te ’s-Hertogenbosch als dochter van Kees van Sluisveld en Annelies Boom. In 2005 behaalde zij haar Gymnasiumdiploma aan het Stedelijk Gymnasium te ’s-Hertogenbosch.

Na de middelbare school is zij Biomedische Wetenschappen gaan studeren aan de Radboud Universiteit. Na het behalen van de bachelor in 2009 volgde zij de master Health Technology Assessment.

In december 2011 is Nelleke, in het kader van het Patient Handover Intensive Care Unit Improvement-project, begonnen aan een promotietraject bij het Scientific Institute for Quality of Healthcare (IQ healthcare) en de afdeling Intensive Care van het Radboud UMC. In 2016 werd het promotieonderzoek, waarvan in dit proefschrift de resultaten worden gepresenteerd, afgerond.

Sinds april 2015 is Nelleke werkzaam bij Zinzia Zorggroep, een verpleeghuiszorg organisatie als senior adviseur kwaliteit & innovatie.

Nelleke is getrouwd met Joost Hendriks en zij wonen samen in Cuijk.

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